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AN
INAUGURAL DISSERTATION

ON THE
*Operation of Pestilential Fluids upon the large Intestines,
termed by Nosologists*

DYSENTERY.

SUBMITTED TO THE PUBLIC EXAMINATION OF THE FACULTY
OF PHYSIC, UNDER THE AUTHORITY OF THE TRUSTEES
OF COLUMBIA COLLEGE IN THE STATE OF NEW-YORK,

WILLIAM SAMUEL JOHNSON, LL. D. President,

FOR THE DEGREE OF

DOCTOR OF PHYSIC,

On the 3d of May, 1797.

By WILLIAM BAY,

Citizen of the State of New-York.

*“ Hæc igitur subito clades nova, pestilitasque,
“ Aut in aquas cadit, aut fruges persidit in ipsas,
“ Aut alios hominum pastus pecudumque cibatus,
“ Aut etiam suspensa manet vis æere in ipso;
“ Et cum spiranteis mistas hinc ducimus auras
“ Illa quoque in corpus pariter sorbere necesse’st.
“ Consimili ratione venit bubus quoque sæpe
“ Pestilitas, etiam pecubus balantibus ægror.”*

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INAUGURAL DISSERTATION

ДНЕ МО

Termined by Topography

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BIBLIOTHECA
REGIA
MONACENSIS

On the 24 of May 1897.

34 WILLIAM BAY.

Citizen of the State of New-York

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APPENDIX.

INTRODUCTION.

PUTRID vapours have been considered, from the earliest ages of physic up to the present time, to be the cause of many of the diseases which have wrought so much mischief among the human species, and which still continue their ravages and influence in destroying so many of the inhabitants of this globe: and as men applied particular terms to designate the different forms of those diseases which are produced by these vapours, an etymology of these may not, perhaps, be uninteresting to some of my readers, and more especially as we are at present labouring under the influence of them; and by this means the fallacy and impropriety of them will more evidently appear.

The Egyptians, previous to their knowledge of the alphabet, preserved their transactions by reducing them into pleasing stories or allegories: these were handed down from generation to generation. “ The allegory which refers to the present
“ argument is the one, mentioned by Ovid,* of the terrible
“ monster *Python*, engendered from the putrid slime or mud
“ of the Nile, and slain by *Apollo*, the god of day. The
“ Mythologists generally agree that this is a beautiful physical
“ allegory. The term ‘*Python*’ is derived from the verb *πυθω*,
“ to putrify or corrupt; and the truth intended to be inculcated
“ is, that pestilential vapours, the offspring of corruptions,
“ cease to rise and contaminate the air, after the sun’s rays
“ have dried the land. The rays or shafts of light, then,
“ darted to the earth, destroyed *Python*, that is, exhaled the
“ moisture,

* *Metamorphosis. Lib. i. 438.*

“moisture, and put a stop to putrefaction and its destructive
 “consequences. The Greeks, who borrowed much of their
 “knowledge from Egypt, interpreted *literally* some of these
 “philosophical allegories. Hence the epithet ‘Pythios’ was
 “given to Apollo by some of his worshippers; and under
 “this title the inhabitants of Megara erected a temple to his
 “honour.* His priestesses, even at Delphos, were called
 “*Pythias*. And further to perpetuate this benevolent action,
 “the Pythian games were instituted, wherein the victors were
 “crowned with garlands of beechen leaves. This author’s le-
 “gend also of the voyage of the god ÆSCULAPIUS to Rome,†
 “in the form of a serpent, with the committee of Roman
 “citizens sent by the senate, during the rage of the plague in
 “Italy, between the 458th and 462d years of the city, to
 “fetch him from Epidaurus,‡ appears to be nothing more
 “than another allegory, or popular story, expressive of the
 “method taken by the Roman government to procure, from
 “the better informed Greeks, all the information they could,
 “about preventing and stopping pestilential distempers. As
 “Æsculapius was reputed the son of the Deity, to whom a
 “surname was given from the monster or serpent he was al-
 “leged to have killed on the banks of the Nile, it is proba-
 “ble, when the figurative meaning of the allegory was drop-
 “ped, the literal interpretation of ‘Pythius’ was transferred
 “from father to son, and thus a snake came to be the type or
 “emblem of physic. Some pleasant remarks have been made
 “on this subject by Sir SAMUEL GARTH.§ I wish some
 “Apollo would destroy the PYTHON of the United States!

“From the same root whence Python is derived, probably
 “come *πῦρ*, fire, and *πῦς*, corruption; expressive of the de-
 “composition of natural substances by *combustion* and *pu-
 “trefaction*. It must have occurred to mankind, very soon
 “after

* Plutarch in Vit. Anton.

† Metam. xv. 622.

‡ 3 Rollin’s Roman History, 305.

§ Works, p. 153.

“ after they began to make observations, that when vegetable
 “ and animal bodies lost their living energy, or died, they
 “ soon underwent an alteration, and laid aside their old, and
 “ took upon themselves a new form; and that such of them
 “ as were not changed by the operation of *fire*, would yield
 “ sooner or later to the agency of *corruption*. They must
 “ soon have discovered, not only that these were the *two*
 “ great destroyers, but that there was a considerable resem-
 “ blance in their manner of accomplishing their respective
 “ works; and that decaying bodies, which frequently evolved,
 “ during their decay, a great quantity of heat, were, in such
 “ cases, under the influence of both $\pi\upsilon\rho$ and $\pi\upsilon\rho\acute{o}\nu$ at once.—
 “ Hence, in constructing their language, the Greeks, in this
 “ instance, as in an abundance of others, most correctly
 “ kept up an analogy *in words*, corresponding to what they
 “ observed in fact.

“ As long as they confined these terms to express certain
 “ changes incidental to *inanimate* objects, the ideas suggested
 “ by this methodical language preserved their correctness.
 “ But, in ancient times as well as in modern, there has been
 “ a constant disposition to transfer the terms appropriated to
 “ processes or modifications of *dead* substances, to express
 “ the conditions and functions of *life*. This is a source of
 “ much inaccuracy in speech and ambiguity in science. For
 “ example, the noun $\pi\upsilon\rho$, which signifies fire, is sometimes
 “ employed by HIPPOCRATES to express a disease in which
 “ a *violent heat* was a leading symptom. From this sprung
 “ $\pi\upsilon\rho\acute{\epsilon}\lambda\omicron\varsigma$, a word often used by the old physicians, and also by
 “ the four evangelists, (even by LUKE,* who, as Dr. FRIEND
 “ observes, wrote the best medical Greek of them all) to signify
 “ a disorder in which *much heat* was accumulated. Thence,
 “ likewise, came $\pi\upsilon\rho\acute{\epsilon}\xi\iota\varsigma$, which appears to have been a more
 “ technical or professional term, meaning a distemper in which
 “ a *fiery heat* prevailed. The colonies of Greeks who set-
 “ tled

* Chap. iv. 38.

“ tled in Latium, called afterwards Latins, adopted different
 “ modes of expressing these ideas: for that form of sickness
 “ wherein ‘fire’ was supposed to predominate, was called
 “ by names derived from ‘fervor’ and ‘flamma,’ which
 “ come from Greek radicals, signifying *to be boiling or burn-*
 “ *ing hot*: and hence the latinisms *fever* and *inflammation*,
 “ which are so common at this day in our own tongue: and
 “ where ‘putrefaction’ was judged to prevail, they expressed
 “ the forms of it by *putreo*, *putrefacio*, *putresco*, *putridus*, &c.
 “ all derived from *πυρ*, or *πύρρα*, whence comes the hellen-
 “ ism ‘putrid,’ and its kindred words.

— “ Such is the origin of a set of terms, which are too firmly
 “ established for any authority on earth to alter, notwithstand-
 “ ing they incessantly suggest false ideas to the mind. They
 “ have, from the time of their adoption to express any thing
 “ resulting from animation, perpetually bewildered those who
 “ employed them as mediums of thinking and reasoning on
 “ the causes of these kinds of diseases; which have according-
 “ ly been pronounced to be either *inflammatory* or *putrid*,
 “ or of a *mixed sort*; as if the body of a living animal, in
 “ which neither combustion or putrefaction can take place,
 “ was subjected to the same accidents which disorganized a
 “ corpse!—To complete the joke, as diseases accompanied
 “ with *great* heat were called by a name synonymous with
 “ *fire*; so, where the heat was *small*, they were expressed by
 “ a word signifying *smoke*; and such is the typhus (*τυφος*,
 “ *fumus*) of the present day! From the difficulty of making
 “ revolutions, or even reformations, this pernicious effect of
 “ words upon ideas, and of language on opinion, will pro-
 “ bably last for ages.”*

The foregoing etymology is much confirmed by the follow-
 ing communication of the learned JOHN C. KUNZE, S. T. D.
 Professor of the Oriental Languages in Columbia College, to

* Mitchill's letter to Thomas Charles Hope, M. D. published in the
 New-York Magazine for February, 1797, p. 64 and 65.

to Mr. MITCHILL, of 28th February, 1797. " Recollecting
 " our conversation of yesterday, concerning the probable de-
 " rivation of $\pi\upsilon\rho$, I just open my SCAPULA, and find under
 " $\pi\upsilon\theta\omega$, from which he derives $\pi\upsilon\omega\omega$, something that favours
 " much your intimation. He derives from the mentioned verb,
 " the words $\pi\upsilon\omega\varsigma$ and $\pi\upsilon\omega\nu$, colostrum or the *first milk*, but says,
 " that the same word is sometimes found for *putrefied blood*.
 " Under that he has $\pi\upsilon\alpha\rho$, and gives the explanation, idem
 " quod $\pi\upsilon\omega\varsigma$. HESYCHIUS calls that *first milk*, $\pi\upsilon\rho\iota\alpha\lambda\omega\nu$;
 " others $\pi\upsilon\rho\iota\alpha\lambda\eta\varsigma$; and in some, SCAPULA does not say where,
 " it is found $\pi\upsilon\alpha\rho$ and $\pi\upsilon\alpha\rho\iota\eta\varsigma$; $\pi\upsilon\rho$ therefore may have its
 " origin from $\pi\upsilon\alpha\rho$, and this from $\pi\upsilon\omega\omega$ or $\pi\upsilon\theta\omega$.—It appears to
 " me a little remarkable, that the Hebrew word באש (baesch),
 " which signifies to putrify, seems to admit of no other deriva-
 " tion. 'B,' being a preposition, mostly rendered *by*, or *in*, or
 " *through*; and 'esch,' *the fire*. Baesch, therefore, signifies
 " *by fire*; the two words for *fire* being esch and ur." Does
 not the $\pi\upsilon\rho$ of the Greeks come from the ur of the Hebrews?

It will appear from this etymology of these terms and their derivatives, which are so often used in medical language, that they are of an allegorical or metaphorical nature, and invariably suggest ambiguous or erroneous ideas to the mind.

A very erroneous conclusion has been drawn by physicians, that the diseases arising from the exhalations of dead animal and some of the vegetable substances, during corruption, are putrid. They have not considered, with that attention which they ought, that, after putrefaction is past, or during its progress, the vapours produced are, with regard to inanimate matter, highly antiputrescent. The carbonic acid gas (fixed air), which is extricated in great abundance during putrefaction, is known to be a powerful preventive of the corrupting process; and the same is true of the septic (nitric) acid and volatile alkali. It is impossible that substances which have undergone the putrefactive process should still be putrid; we might with equal propriety say, that substances which

B

have

have undergone combustion were still burning. The operation of putrefaction and combustion both resolves the compound body of the plant and animal into their simple elementary particles; and to assert that the products arising from putrefaction possess a power to putrify every thing in their neighbourhood, has just as much reason and propriety to direct them, as to affirm that the products of combustion possessed the power of setting fire to every thing with which they came in contact. But the fact is, that substances having undergone combustion, are ever afterwards incombustible; and bodies, after the process of putrefaction, are ever afterwards antiputrescent. Pestilential fluids being produced by putrefaction, may be called *septic*, as respects their origin and title, but are clearly antiseptic in their effects.

Exhalations from putrefying animal substances have been called putrid: this term appears to be very improper, and every where to have introduced much confusion into medical reasoning; the truth of which will be manifest from the following experiments of Alexander.

This accurate and able inquirer has proved that these vapours are not only not putrid, but highly antiseptic in their operation. He found that the most nasty and offensive water from ditches, puddles and sewers, were capable of preserving beef and mutton from putrefaction much longer than pure water. This was found to be true of the water of the North loch, the ditches in the meadows, and the drainings from the Connogate of Edinburgh, and the water of St. James's Park and Fleet ditch in London: that these waters contained putrid matter in sufficient quantity to make them fit materials for such experiments, no one will presume to doubt. Raw meats put to macerate in these liquids, and hung in their vapours, were universally found to be less liable to corrupt than when exposed to common air or common water. From the experiments the author concludes, that these antiseptic vapours could not be the cause of those kind of fevers termed putrid.*

These

* Alexander's Experimental Inquiry, ch. vii. p. 62.

These antiseptic vapours, produced from putrefaction, which cause the diseases that have been termed putrid, have been proved, by the professor of chemistry, to be a combination of the principle of putrefaction (septon) with the principle of acidity (oxygene). And here too, a power of words, different in derivation and in signification, embarrasses the inquirer. Term after term has been adopted to express the radical of these destructive fluids. The term nitrogene is derived from the nitre from whence it is obtained by art, by means of decomposing that salt, which is formed by the union of this acid with pot-ash: but as this word does not convey to the mind any idea of its real origin, it is discarded by him, and the word septon is substituted, as being a term which will excite in the mind a clear conception of its origin. The term septon is a neuter adjective from the Greek verb sepo, to putrify, it being the production of putrefaction. The adjective is used as being a more elegant manner of expressing it, and strictly coincident with true criticism, after the manner of Cicero, Longinus, and other authors who are justly considered as the models of elegance. And as the term septon, the principle of putrefaction, and its derivations, are used throughout this treatise, I shall annex a nomenclature in this place, in order that the terms so used may be understood by such as are unacquainted with this innovation.

Septon, for azote or nitrogene.

Septous gas, for azotic gas or atmospherical mephetis.

Gazeous oxyd of septon, for dephlogisticated nitrous air.

* Septic gas, for nitrous gas

* Septous acid, for nitrous acid.

Septic acid, for nitric acid.

Septate, septite, for nitrate, nitrite, &c.

* Chemists heretofore have principally confined their researches to the septic gas and septous acid, and in a good degree overlooked those combinations of the principle of putrefaction (septon) with the principle of acidity (oxygene), which exist, naturally formed, during the spontaneous decomposition of animal and certain vegetable matter. The septic gas and septous acid never exist

naturally formed, or at least for a very short time, but are always the products of art; and on this account chemists have neglected those forms of pestilential fluids which are produced in the laboratory of nature. This error has therefore caused some difficulty in comprehending the new doctrine of contagion, because, if the nitrous acid was the cause, they argue, it would be perceptible to the sight, as this acid emits red vapours; and as this does not appear during putrefaction, therefore it does not exist, and consequently cannot be the cause of malignant diseases. But they do not recollect that the septic gas and septous acid cannot exist long in their artificial forms, when exposed to the atmosphere; for such is their attraction for oxygen, that they absorb it from the common air until they are saturated with it; by which their volatility is in some degree diminished, and their colour changed from orange to pale, forming the colourless septic acid. This, and the gaseous oxyd are the only forms in which it exists, or can long exist naturally and in the open air. This is corroborated by the effect which takes place in obtaining the septous acid: salt-petre is used for this purpose, being the septite of pot-ash: a stronger acid is added to the salt-petre in order to disengage the septic acid. There are two products from this, the one a portion of oxygen, in the form of vital air (oxygen gas) and the other, the smoking septous acid of the shops. If it was not the septic acid which was combined with pot-ash to form the salt-petre, this oxygen gas could not be evolved; and consequently, as salt-petre is found naturally formed in some countries, it follows, that the septon, or basis of the acid, must have been saturated with the principle of acidity, and thus constituted the oxygenated septic acid, before its junction with pot-ash to form the nitre: and such seems to be the natural progress of things.

AN
INAUGURAL DISSERTATION
ON THE
DYSENTERY.

CHAP. I. *Of the Physiology of the Alimentary Canal.*

SECT. I. *Of Digestion.*

PREVIOUS to the history, or any practical observations on the disease which I have chosen for the subject of this dissertation, I shall, in the best manner I am able, consistent with the limits of a dissertation, describe some of the functions of the alimentary canal: inasmuch as health depends upon their being performed with freedom and ease, whatever, therefore, disturbs or impedes these functions, becomes the cause of disease.—The digestion of the food is one of the most important operations in nature, for the maintenance of animal life: from some impediment or disturbance of this process, a great number of diseases, and complaints of various kinds, arise. It may, therefore, be proper to consider digestion first; for organs of digestion, of some kind or other, are common to all animals with which we are as yet acquainted.

Digestion, in the animal œconomy, is the decomposition which the aliment undergoes in that viscus called, by anatomists, the stomach, by the operation of a fluid secreted in that organ, to which physiologists have annexed the term of gastric juice.

juice. This liquor acts upon the food, by means of a solvent power peculiar to itself; fits it in such a manner that the nutrient parts are easily separated from the mass, and taken up by the numerous absorbent vessels which are plentifully distributed throughout all the smaller intestines. The nutritive portion, called the chyle, is carried by the lacteals to the receptaculum chyli; whence it passes on, through the thoracic duct, into the left subclavian vein; there it mingles with the circulating mass, and is converted into blood. By this means the bulk of young animals are enabled to grow until they have arrived to that size which nature has prescribed to each particular species; and also to repair the waste and loss which the system of the mature animal is constantly subjected to, from continual exercise, while in the full performance of its functions.

Preparatory for digestion, the solid food received in the mouth is divided into small parts by the teeth, and blended with the saliva, a liquor secreted from the blood by the salivary glands, for the purpose of moistening the mouth, and also to mix with the food during mastication, to form it into a pulp, by which means it is more readily swallowed. The saliva is necessary, in some degree, at all times, to moisten the mouth and fauces, but in far greater quantities at meals, when it is required to be mixed with our aliment: on this account nature has taken care that the taste, smell, and even the sight of food, instantly excite a proper secretion of saliva.

The food thus divided, and, by the mixture of the saliva, air, and the mucus of the fauces, blended into a pulp, is swallowed, and descends into the stomach, where it mingles with a fluid of a more active nature, termed the gastric juice. This subject has, for a considerable time, agitated the minds of the medical world; and a variety of opinions prevailed among the ancients, respecting the manner in which digestion was performed in the human stomach. Similar controversies have subsisted among the moderns; many, in addition to trituration
and

and putrefaction, have imagined that fermentation takes place in the stomach for the purpose of digestion. About the end of the last, or the beginning of the present century, the ancient doctrine of trituration was revived. But Boorhaave considered none of the powers, supposed by physicians, both ancient and modern, to be the sole agent of digestion singly; he supposed the energy of the whole were indispensibly necessary in this process. Those who are the warm supporters of trituration, as being the true mode by which digestion is performed, bring in as a proof of their theory, that birds cannot digest their food but by this means. But the experiments lately made by the ABBE SPALLANZANI, *professor of natural history at Pavia*, prove that the stomachs of those animals require no such auxiliaries; for he found from these experiments, that their food is digested by means of a solvent power in the gastric fluid, secreted by their stomachs. He inclosed the food unbroken, in perforated tubes, which were given to a turkey; it came away without being digested; but on breaking the food it was returned; when it was again voided, there were not the least remains of food in the tubes.* Hence it appears evident, that trituration only accelerates digestion, but is not absolutely necessary; for the muscular power of the stomachs of those animals have no more agency in digestion than the teeth of those animals who are provided with them; consequently trituration has no more the power to digest the food than chewing. By chewing the food the gastric juice acts more speedily upon the mass, from the greater number of points it has to act upon, than it would have were it a solid mass. But whatever be the power of digestion in these animals, there is but little analogy between their muscular, and the membranous stomachs of men; than for which nothing can be less calculated than for the breaking and grinding of hard substances. Had the human stomach seemed better formed for such a purpose, and had its triturating powers been calculated at even a higher rate, still

* Vide Spallanzani's Dissertations, vol. i. sect. 62. p. 64 and 65.

still it would have been evident that it performed no such function; for every day's observation would be a proof against it, from the swallowing whole currants, cherries, and ripe grapes, which burst on the least pressure, and which are voided very frequently whole and unbroken. These observations, with the experiments which have been adduced, will, I trust, be sufficient to overturn at once the doctrine of trituration. These experiments with the hollow tubes, although decisive proof against trituration in the human stomach, argue nothing inconsistent with the theory of a certain degree of fermentation being requisite for digestion.

It seems difficult, however, to imagine how any degree of fermentation can take place, without our being put in mind of it in the most disagreeable manner; yet it is only when people are in ill health, and digestion is weakened and disturbed by disease, that any feeling or effect that can be imputed to fermentation is perceived. In good health, and while we avoid excess and improper food, the process of digestion is carried on quietly, without our being informed of it by any disagreeable sensation.

Chemists consider three kinds of fermentation—the vinous, acetous, and putrid. Vomitings of a vinous smell, which sometimes occur even when no wine has been drunk, and the frequent acid eructations with which people are sometimes afflicted, are brought as proofs that the two first kinds of fermentation do exist in the stomach during the process of digestion, and they therefore conclude, that they are necessary agents in this process. Animal substances, however, in no circumstance, not even in a state of putrefaction, undergo the acetous or vinous fermentation: whenever sour eructations, or spitting, therefore, happen, after eating animal food, they cannot, surely, be imputed to the acetous fermentation of the meat. This, with what has been remarked above, that no such disagreeable circumstance attended people in good health, while the digestive organ is in its natural state, renders

renders it more than probable that those symptoms proceed from some other cause than the healthy digestion.

This, however, can be proved beyond a doubt, from the experiments of STEVENS. He collected the gastric juice of a dog who had been fasting eight hours: having put half an ounce of it into a phial with twelve grains of beef, and also the same quantity of water and beef in another phial, he placed them in a furnace heated to 102. 3. of Fahrenheit's thermometer: he examined the contents of the phials eight hours afterwards; the one that contained the gastric fluid was intirely dissolved, while the other had not undergone any sensible change. In twenty hours afterwards the whole was removed from the furnace, after having examined them attentively. The beef which had been immersed in the gastric juice, emitted a *rancid and pungent odour*, while the other had become *putrid, and emitted an intolerable stench*. During the intire solution of the beef in the gastric fluid there was not the least appearance of *air bubbles* arising to the surface, nor did it shew any *signs* of fermentation.* This experiment was repeated with the same effect. SPALLANZANI† added to some of the mafs of digested substances the syrup of violets; but no change of colour took place, as might necessarily have been expected, had there been the least degree of acidity present in the mafs. Hence, then, it appears, from the experiments adduced, that the acetous and vinous fermentations have no agency whatever in the process of digestion, further than in the imaginations of its advocates. This theory, then, like that of trituration, is founded upon hypothetical reasoning, and must, like all the other doctrines founded upon the same principle, give way to the more rational, formed upon the strong basis of experiment.

The opinion of those who support the doctrine of putrefaction, and consider that some degree of it is necessary to com-

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plete

* Vide Stevens's Dissertation, experiment 23.

† Vol. i. p. 343.

plete digestion, and that it actually does take place in the animal part of our diet, before it leaves the stomach, has been combated by various arguments. It has been observed, that the saliva of those who have fasted for a considerable time, is in some degree acrimonious; so are their other juices; and even their breath, though naturally sweet, is then offensive; but these disagreeable symptoms soon disappear after the taking of food. When a nurse continues too long without taking any nourishment, her milk becomes *rank and bitter*, and the child rejects it with disgust; but no sooner does she take in a fresh supply of food, than these will disappear, and her milk becomes as *fresh and sweet* as before.*

It therefore appears, that no degree of putrefaction takes place in digestion for the conversion of our food into chyle; and if putrefaction was necessary for that purpose, it would of course, by means of the chyle, be communicated to all the fluids of the body; and the breath, saliva, and milk, instead of being sweetened, would be rendered more offensive in consequence of eating. Hence, if what has been just related is true, as it is, of the saliva, breath and milk, then it is equally true that those qualities are changed, and sweetened in consequence of eating; and if this is the case, then certainly the conclusion follows, that putrefaction has no agency in digesting the food. Independent of the above arguments, this position can be proved from facts which neither can or do admit of a single doubt.

SPALLANZANI† has, by experiments, found that animal food, so far from becoming putrescent while under the operation of the gastric juice, will, if it has undergone a certain degree of putrefaction, be rendered sweet and pure again. Hence, then, it will appear, that the gastric fluid, which is continually flowing into the stomach, so far from being septic, is highly antiseptic; consequently, instead of promoting putrefaction,

* Moore's Medical Sketches, p. 83.

† Vide p. 349, 353, 355, vol. 1st.

trefaction, will retard it. That neither of the fermentations can have any agency in digestion is now certain; and as the favourers of this doctrine were obliged to consider nature as deviating from her general plan of simplicity in this case only, while in all her operations we see her strictly adhering to her principle, this would be absurd: for the phenomena of digestion cannot be explained as produced by either of the three kinds of fermentation alone; consequently two must be taken in, either the vinous or acetous, with the putrid; for, while we make use of vegetable diet, the acetous or vinous fermentation ought to take place according to this theory; and, on the contrary, when animal food is used, then the putrid must be the cause. But, from the experiments of modern physiologists, we find that nature, in this as well as in all her other operations, strictly adheres to her first principle of simplicity, by endowing the gastric juice with a power which can act with equal force, whether the diet be vegetable or animal, by means of a menstruum. For this discovery we are indebted to chemistry, which has taught us the knowledge of solvent powers in dissolving bodies: it is by the assistance of this beautiful branch of science, that we are enabled to account, in the most satisfactory manner, for the various phenomena which appear throughout nature's works. It is to this that mankind is indebted for that knowledge of contagious and infectious fluids, which has been communicated to the world by Professor MITCHILL. It is to this science that mankind is indebted for many improvements which medicine has experienced, and for a better understanding of some diseases which had before eluded the researches of the ancients. That a solvent power in the gastric fluid is the means by which the food becomes digested, will readily appear from the facts already adduced to corroborate the arguments advanced: but, in order to dispel any doubt which may yet remain, I shall bring forward a few more facts to substantiate the assertions. The experiment made by REAUMURE is decisive and satisfactory to prove the

the point in question, while, at the same time, it shews the falsity of the other three. He took a buzzard for the purpose of his experiment, because that bird has a membranous stomach, and therefore can possess no great degree of triturating power; but, in order to preclude every mechanical power, he made use of tin tubes, perforated so as to admit free ingress for the fluid secreted by the stomach, to the matter which was used in the experiment: on examining the meat contained in the tubes, after they had remained twenty-four hours in the stomach of the animal, it was reduced to three-fourths of its original quantity: that which remained had the appearance of threads; it was neither *putrid*, *sour*, nor *volatile*, but *totally insipid*.

SPALLANZANI* gave to a dog a portion of bone, inclosed in tubes: when he came to examine the contents, he found that it had undergone a considerable diminution from the operation of the gastric fluid; the remainder was rendered soft, and easily cut with a sharp instrument. He† made the same experiment upon himself, and proved that man is capable of digesting the softer parts of bone, while the harder lost also considerable of its weight. Hence, then, it follows, that neither trituration nor the different fermentations could be supposed to have any agency in producing the changes which the bones underwent in the stomach of the dog, or in that of the experimentalist; but that this change could only be wrought by the solvent power of the gastric juice. From the food's being digested by means of a solvent power in the gastric liquor, a question will arise, how the stomach escapes this operation, being composed of the same materials with the food? This, the celebrated anatomist, JOHN HUNTER, has, with a great deal of ingenuity, proved, that the same living principle which resists the putrid tendency in the blood and other fluids, prevents the stomach itself from being acted upon by the gastric juice; but as soon as the stomach loses this principle, it is as

liable

* P. 259, 278.

† P. 340, 1.

liable to be acted upon by this fluid as any part of our food. In confirmation of this, it is only necessary to advert to the common circumstances of worms in the stomach: while they retain the vital principle, they are a proof against the solvent power of the gastric juice; but no sooner are they deprived of this resisting power, than they become as liable to the operation of this menstruum as any other substance taken into the stomach. It was owing to this principle that JONAH remained three days in the stomach of a whale undigested; upon which infidels have founded so great an objection to the holy record, as being miraculous; but it only shews their ignorance of one of the greatest laws of the animal œconomy, that, so long as the living principle remains in animal bodies, so long are they proof against the powers of digestion. From dissections it appears, that the stomach becomes frequently digested; that the gastric fluid has been found to corrode it, and to have made its way through the coats of the stomach into the cavity of the abdomen. JOHN HUNTER* relates three cases where he observed that the stomach had been acted upon by the gastric fluid: two of them died from blows which they received upon their heads, which fractured their skulls; they both died in a very short time after the accident: the other was in a person who had been hanged. From the appearances of their stomachs, and the suddenness of their deaths, it cannot be attributed to any putrefaction that they could have undergone, or to any disease of the stomach; for in all the cases the subjects were in perfect health previous to their deaths. Thus far have I endeavoured to shew the true process of digestion, so far as it relates to the stomach, where digestion is only begun, and is afterwards completed in the smaller intestines. From the remarks that have been made on digestion, we find that the process of concoction, which is only begun in the stomach, is afterwards completed in the smaller intestines, and there the aliment is converted into chyle.

SECT.

* Vide Animal Economy, p. 230, note.

SECT. II. *Of Chylification.*

CHYLE, in men and quadrupeds, is of a white colour, resembling milk; it is commonly of a saltish, sweet taste, but has not any sensible smell. In fish and birds it is transparent, like water. When it is effused out of the lacteals of a healthy person, it coagulates like milk. It has been found to curdle in the lacteals after death,* provided the animal was in full health and vigour.

HALLER was of opinion, that an acid prevailed in the chyle, which prevented the putrefaction of the blood. His words are, “*utiles chyli proxima est, putrescibilem naturam sanguinis acido succo suppeditato contemporari. Absque chylo enim, ut ostensum est, omnes succi humani in summam acrimoniam transeunt, et fibris accenditur intra paucos Dies funesta.*” CRUICKSHANK† denies that there is an acid present in the chyle: from the variety of experiments which were made, he could not perceive any acid, either by taste or smell; nor, on adding the salt of tartar, did the least effervescence take place; neither was the colour of the litmus changed in any manner by being immersed in the chyle, which is considered a very delicate test to discover the presence of an acid. Further, it is impossible that an acid can exist in this fluid; for the bile, which is present and mixed with the substances to be formed into chyle, is an alkalascent fluid, consequently no acid can exist, because the instant the acid and the alkali come in contact, an effervescence will take place, and form a neutral salt.

Chyle is a fluid into which our food is changed in the stomach and small intestines, by means of the gastric fluid and the pancreatic juice, which is absorbed by a set of vessels plentifully distributed over the smaller, and also the two large intestines

* Cruickshank, p. 101.

† P. 100.

intestines (the cœcum and the colon), but in greater numbers over the duodenum and ilium: these vessels, from the resemblance of the fluid they take up to milk, are called the lacteals; by means of these vessels the chyle is brought to the thoracic duct, from whence it passes through that canal into the round of circulation. The importance of this fluid, and the necessity of it, in order to support life, must be obvious to every physiologist, if, by means of disease or any accident, the animal is prevented taking in food; or even if the creature does take in food, and digestion is carried on completely, yet, if the mesenteric glands be diseased, or the lacteals themselves either debilitated or in a paralytic state, even then the animal will starve as certainly as if he had been fasting.

It was for a considerable time the received doctrine, that the function of absorption of the chyle was performed by the red veins, together with their office of carrying the blood to the right ventricle of the heart.—JOHN HUNTER, to whom we are much indebted for the useful discoveries which he has made, positively denies this office to belong to the veins: he made a number of experiments to prove the falsity of this doctrine, which are conclusive: there are a number of them recorded in the work of CRUICKSHANK;* I shall transcribe one of them, for the satisfaction of my readers, as the works of the above-mentioned authors are somewhat rare in this country. “After one of the animals had been properly secured, and the abdomen opened, portions of the intestines were quickly emptied, by pressure, of their contents, and warm milk was injected in their place, and confined by ligatures. The veins belonging to these portions of intestines were emptied of their blood, by punctures made in their trunks, and prevented from receiving more blood, by ligatures made on the trunks of their corresponding arteries. In this state the parts were returned into the abdomen; and by their veins being left thus empty, even an absorption of
“ a small

* Vide p. 22

“ a small portion of milk would have been detected, as the
 “ coats of the veins are so thin, that they would have per-
 “ mitted a white fluid to appear through their sides as readily
 “ as red blood. The parts having remained in the abdomen
 “ a quarter of an hour, half an hour, or more, they were
 “ again allowed to protrude, and carefully examined: the veins
 “ were nearly as empty as when the parts were first returned,
 “ and contained not one drop of white fluid; but the lacteals
 “ were filled with it.”

The precaution in emptying the veins was quite unnecessary, for if the milk had mixed with the blood, it would have been easily detected; for the chyle is perceivable in the left subclavian vein, where the thoracic duct empties the chyle into it. Hence it appears, from this experiment, that the lacteals are the absorbing vessels of the chyle, and not the veins. Some will object to this experiment, because the animal on whom it was made must have been under the operation of a considerable degree of pain during the experiment, and on this account not satisfactory; but, in answer to this, it may be considered, that the lacteals were not prevented from absorbing the milk from the pain which the victim experienced during the time the experiment was making, and, consequently, will be sufficient to do away that objection. Nature, in all her works, has studied the most simple possible manner in the structure of her machinery, and has allotted to each its proper functions, so that no one has to perform more than one office at the same time; as she has in no wise deviated from her plan, certainly she would not in this instance be guilty of inconsistency, and wander from her original plan, by giving to the red veins the double office of absorbing the chyle, and of returning the blood to the heart: she has, therefore, provided the intestinal canal with a set of vessels, whose express purpose it is to take up the chyle, and see it safely lodged in the left subclavian vein. There are other absorbent vessels distributed over every cavity, and the surface of the whole body, which absorb

absorb moisture from the atmosphere and the lymph which happens to be deposited in the cavities: it is by means of these vessels that the body is operated upon by contagion, together with the pulmonic organs, and the stomach; these vessels take up the matter of contagion, and carry it into the circulation. This will be more fully explained in another part of this dissertation.

SECT. III. *Of the Properties and Use of the Bile.*

PREVIOUS to my offering any remarks upon the secretion of the bile and its properties, it will not be foreign to my subject to give a brief anatomical description of the organ destined for this purpose. The liver is the largest gland in the body: it occupies a considerable portion of the abdominal cavity: its figure is irregular in the human subject; it is somewhat flattish, convex on its anterior, and irregularly concave on its posterior surface: it is divided into two lobes, named the right and left, of which the right is the largest. Besides these, there is another smaller, called lobulus spigelii: it is contained in the right hypochondrium, and part of the epigastric region. The peritonæum, which covers the liver in common with the other viscera of the abdomen, doubling upon itself, is attached to the diaphragm, which forms the ligaments, for the purpose of retaining the liver in its proper situation. The falciform ligament is situated directly opposite the termination of the great fissure, which divides the liver into the right and left lobes; it is also frequently called the suspensory ligament, from its suspending the liver from the diaphragm. There are two others, called, from their situation, the lateral ligaments. Besides these, some reckon two others; the one is a portion of the peritonæum, which surrounds the blood vessels called coronary; the other, the ligamentum rotundum: this

is the remains of the umbilical vein: but there is no ground for believing that they perform any ligamentary functions.*

In a depression on the concave surface of the right lobe of the liver is found the gall-bladder, to which it is attached by the peritonæum. It is of a pyriform shape; its neck, or small extremity, being situated superiorly; its fundus, or large extremity, inferiorly.

Every organ destined by nature for the purpose of secretion, is very plentifully furnished with blood, especially those that are intended to secrete fluids which are of the greatest importance in the animal œconomy. The liver, from the great importance of the bile in assisting in some of the highest functions, is accordingly copiously provided with blood, which is very different from what is carried to the other glands for the purpose of secretion: while the blood from which all the different glands secrete their fluids is arterious, that of the liver alone is venous. The liver, like the other parts of the body, receives its nourishment from the sanguiferous system. But blood of every description is not fit for nutrition; that only which has received the change of respiration, and which circulates through the arteries, is adapted for the support of the animal. The liver receives its nutriment, therefore, from the hepatic artery: this artery is the third and largest branch of the cœliac. The blood from whence the bile is secreted, is a collection of all the blood sent to the peritonæal viscera (the liver excepted), whose veins unite into one large trunk, called the vena portarum: after this vessel arrives at the liver, it branches out into the substance of that gland: the blood which remains after the bile is separated, is carried, by the hepatic veins, (formed by the union of the termination of the vena portarum and the hepatic artery) into the vena cava ascendens.

The secreting terminations of the vena portarum are the beginning of the hepatic ducts, called pori biliarii; these uniting at length, form the hepatic duct; this, in its course to the duodenum,

* Post's Lectures.

duodenum, is joined by the cystic, there forming the ductus cholidochus communis. But, from the peristaltic motion and distension of this intestine, the passage of the bile through the duct will be interrupted, by which means it will be distended; consequently the bile will regurgitate into the gall-bladder through the cystic duct.

This fluid is of a deep green colour, more or less inclined to a yellow, especially when diluted with any watry fluid; of a very bitter taste, and of a pungent, nauseous smell. It is of a gelatinous or slimy consistence, by which means it is easily drawn out into threads, like a clear syrup, and froths like soap when agitated with water in a vessel. When this animal soap is submitted to distillation, it affords a yellow alkaline phlegm, an empyreumatic oil, a considerable quantity of the *carbonate of ammonia*, an elastic fluid united with carbonic acid and hydrogen gas, and the *carbonate of soda*.*

The bile is soluble in water: its colour is changed to a yellow, which will be brighter or darker, according to the quantity of water added. The bile is considered by physiologists to aid the digestion of the food of animals: this supposition is grounded upon the capability of this fluid to unite water and oil, by means of the alkaline salts which are found to be contained in the hepatic secretion. I am inclined, however, to doubt the use of this fluid in the process of concoction. The food, after having undergone the operation of the gastric juice, is found to be a gelatinous, homogeneous mass, and therefore needs not the operation of the bile to unite the different particles together; for those who favour this supposition imagine the substance of our food, after having undergone the first process in the stomach, consisted of oily and watry particles, and on this account needed the intervention of a third substance to combine them; but as this is not the fact, there can be no necessity for an alkaline substance to aid this union. It may be useful, when such a circumstance takes place

* Fourcroy's Chemistry, vol. iii. p. 195.

place from the powers of the principal digesting organ being defective, and the assimilation incomplete; but this is very rarely or perhaps never the case, the food being always or not at all formed into this homogeneous fluid. From the quantity of this fluid secreted, and particularly in that season of the year when *fevers* are most frequent, *I am led to conclude, that its principal use in the animal œconomy is to prevent diseases arising from the putrefaction of animal and vegetable matter.* The product arising from the spontaneous decomposition of animal and vegetable substances causing these distempers, is the septic (nitric) acid; the alkaline nature, therefore, of this fluid, is admirably well calculated to prevent them.

This truly useful and important secretion has been scourged by the physicians of every age, and the greatest abuse has fallen from the pens of all the different authors who have undertaken to write upon autumnal diseases. “The bile, (they say) during the warmth of summer and autumn, becomes putrid, and from this corruption spring the different autumnal fevers.” In order, therefore, to shew the falsity of their doctrines, and to reinstate this very valuable fluid to that rank among the animal fluids to which it is justly entitled, and from which it has been thrown, through ignorance of its qualities, I shall only deduce one experiment, which, I trust, will be found sufficient to overthrow the elaborate doctrines of the putridity of the bile being the cause of these diseases. Equal quantities of blood and bile being exposed under similar circumstances, the blood on the third day became putrid, while the bile shewed no signs of putrefaction until the sixth day, when it began to putrify.* So far, then, from the bile becoming putrid, it is less liable to undergo this change than any of the other animal fluids, and possesses the power of preventing other substances immersed into it from being decomposed.† From the
above

* Saunders on the Bile, p. 110. Exp. 9 and 10.

† Saunders, p. 130.

above experiments, then, it is evident, that the blood has a greater tendency to putrefaction than the bile; and, consequently, in those diseases which are attributed to the putrid state of the bile, the blood must, agreeable to the above experiment, be in a high state of putrefaction; which, if it did exist, the animal must certainly die the instant that it took place, for these reasons: animal fluids, as well as solids, while they undergo the putrid fermentation, have a quantity of air extricated, by which means they are resolved into their elementary parts, which will form new combinations, according to the chemical laws of elective attraction; that is, the *septon*, *hydrogene*, *carbone*, and a portion of *oxygene*. These elementary principles, which enter into the composition of the blood, will, some of them, unite and form different compounds; while others will remain uncombined. Now, it is a well ascertained fact, that if the least quantity of air finds its way into the blood vessels of an animal, instant death is the consequence; therefore, air being generated during putrefaction of the blood, nothing is more certain, if this takes place in the blood vessels, than that the animal must expire in a few moments. Hence, then, it is certain, that putrefaction in the bile cannot possibly take place, for the blood possesses twice the appetency to become putrid that the bile does, and consequently the animal will die before that process can be entered upon by the bile.

Having proved that the bile is not the cause of those diseases called *bilious fevers*, I shall proceed one step further, by declaring that there are no *putrid fevers*, and that the bile, so far from producing or being the cause of this form of diseases, is, in a certain degree, a preventive. In order to prove this position, it will be necessary to discover what the true cause of those diseases are which have been termed bilious. It is found to be a combination of oxygene with septon. That this is the cause, we shall take for granted in this place, as will be proved in another part of this dissertation. This combination will
form

form the septic oxyd, or septic acid, according to the degree of oxygenation. Here, then, is an acid which is the cause of those diseases termed *fevers*, for all *fevers* arise from the same cause, differently modified. The bile contains two different alkalies, the *ammonia* and *soda*, in combination with a weak acid; these alkalies have a stronger attraction for the septic, than for the carbonic acid; and agreeable to the laws of elective attraction, the alkalies will let go the carbonic, and unite with the septic acid, (the weaker being dispossessed by the stronger) and will form the septite of ammonia, and the septite of soda; and this process will continue until the whole acid becomes neutralized, or till the alkalies of the bile become saturated with the acid. Here, then, is a part, if not the whole of the cause of the disease taken out of circulation; and the system will not become diseased, but, from the quantity of the contagious matter being lessened, its deleterious effects will be in a great measure destroyed.

They who contend that the bile is the cause of the numerous autumnal diseases and *fevers*, are led to this conclusion from the quantity of this fluid that is secreted by the liver, and from the quantity which is sometimes discharged in vomiting, appearing black and putrid. This, however, is a very wise provision of nature, to furnish the system with a large proportion of this health-restoring fluid, when the body is most liable to be operated upon by septic acid vapours, arising from the vast masses of putrefying materials which surround them at this season of the year, to prevent, or at any rate to lessen the violence of the attack, which might otherwise carry the patient off. The change of colour in the bile thus thrown out, shews the operation it has undergone, by means of meeting the septic (nitric) acid in the alimentary canal; for this acid, on being mixed with the bile, changes it into a dark colour, resembling coffee grounds. Therefore, instead of finding fault with Providence for supplying the system with this fluid, we should never cease in offering our most grateful
acknow-

acknowledgments to HIM, for placing in the constitution of animals a fluid which is capable, in all ordinary circumstances, of preventing this class of diseases. They further reason, from the yellowness of the skin which takes place in certain distempers of this class, that its peculiar hue is lemon-coloured, and proceeds from a bilious suffusion, as in that disease which arises from a diseased state of this organ. The fallacy of this, however, will readily appear, since, in the distempers called putrescent or malignant, where a yellowness of the skin appears, it is not owing to a diseased state of the liver, but is a dye or stain occasioned by the septic acid (nitric acid) being applied to the surface; for it is a well known fact to those who handle or make much use of this acid, that the parts of the skin to which it is applied will be turned yellow, and exhibit the particular colour which the skin puts on in those persons affected with yellow-fever. The absorption of the bile which takes place in jaundice, will have an effect upon certain of the excretions which is not found in those labouring under yellow-fever. The colour of the urine will be deeply tinged with the bile, the fæces will be of an ash colour: but none of those appearances take place in the yellow-fever. Further, the yellowness of the skin in this fever, never takes place but when the atmosphere is highly impregnated with pestilential vapours, and also not till the latter stages of the distemper. Now, if it was owing to an absorption of the bile, this yellowness of the skin ought to take place in the beginning of the disease, and also to make its appearance in the urine, which is universally the case in the icterus; but this is not the fact. In order to prove that this state of bile which is sometimes discharged of a black and putrid appearance, is occasioned by the septic (nitric) acid will appear from the experiments made by Maclurg and Saunders; the former made his experiments upon human bile. A quantity of human bile, says Maclurg, being mixed with the nitrous acid, its colour was

was changed to a turbid brown.* A quantity of the bile of an ox being mixed with concentrated nitrous acid, it was changed to a brown colour: on mixing them an effervescence took place.†

That the septic acid and the gaseous oxyd of septon are the causes of those diseases, and not the bile, will be evident from the appearances of the blood taken from patients by venesection, and from dissection. The blood is of a dark colour, sometimes thick, and frequently appears to be in a state of dissolution, liable to corrupt in a very short time; forming polypos concretions in the heart: the blood contained in this organ is black and grumous. Similar appearances take place if the septic acid be injected into the blood vessels, or if the blood be drawn into a vessel containing this acid, or the gaseous oxyd of septon.‡

SECT. IV. *Of the Pancreas.*

THE pancreas, or sweetbread, is a large conglomerate gland, of the nature of those which secrete the saliva: it is situated in the epigastric region, under the stomach, between the liver and the spleen: its figure resembles a dog's tongue. It is composed of a great number of small, soft, glandular bodies, combined in such a manner as to exhibit the appearance, on the outside, of one uniform surface, which is rendered uneven by numerous small convexities, more or less flattened. When these small glandular bodies are separated a little from each other, we find, in the center of the gland, a particular duct, in which several smaller ones terminate laterally on each side, like small rami in a stem. This is called the pancreatic duct, through which the pancreatic juice is conveyed to the duodenum:

* Maclurg on the Bile, p. 44.

† Saunders on the Bile, p. 43.

‡ Vide Appendix A.

duodenum: it is sometimes double, but for the most part there is only one. The pancreas is chiefly supplied with blood from the splenic artery; but it also receives some branches from the duodenalis and pylorica, and a few ramifications from the mesenterica superior and gastrica major.

Anatomists and physiologists have observed a great resemblance between the pancreas and the salivary glands. Chemistry has not as yet thrown any great light upon the qualities and properties of the fluid secreted by the pancreas, from the difficulty of obtaining a sufficient quantity of this fluid; but from the observations which have been made from the structure of it, its great resemblance to the salivary glands, and the great likeness of the fluid to that of the saliva, it has been considered of the same nature, and very probably of the same use with that of the saliva. It is a watery, insipid, thin fluid; neither acid nor alkaline, and is poured into the same place with the bile. The quantity of the juice secreted by the pancreas we are also unable to ascertain: if, however, we compare the size of it with the salivary glands, and the number and respectability of the blood vessels of each, [it is supposed to be three times as large as the salivary glands] the quantity will at least be in the same proportion: and further, its situation is much warmer than the salivary glands, being encompassed by the larger viscera of the abdomen. The use of this fluid will appear from this glandular substance being found not only in man, but in almost all the other animals: nor is its use to be judged of from the experiment, which shews that a great part of the pancreas may be destroyed in robust animals without occasioning death; because, in such experiments, a part of it must be left adhering to the duodenum.

With the use of this fluid we are no better acquainted than with its component parts. We therefore cannot speak with any certainty: it appears, however, to be principally of use in diluting the dissolved food, uniting with it in the duodenum, whereby it is rendered so fluid as to be circulated with

greater facility through the absorbent vessels; also to correct and dilute the viscid cystic bile, and to moisten the fæces, in order that they may not injure the intestinal tube, by their becoming hard and indurated, which they would if they were not prevented by this and some of the other fluids which are constantly poured into this canal: in short, it performs, in the lower part of the intestinal passage, all the offices which the saliva does in the upper part of it. This fluid, in uniting and mixing with the bile, makes it more active, in the same manner as water does soap; for without water common soap would be incapable to remove foreign matter from those things in which it is used so effectually as with it.

SECT. V. *The Condition of the Alimentary Canal.*

THE condition of the alimentary canal, which is composed of the œsophagus, the stomach, smaller and larger intestines, is the next to be considered, as it appears in the healthy state. The œsophagus is the tube which conducts the food into the stomach; its inner surface is lined with a great number of small glandular bodies, which secrete a mucus fluid, which serves to make the pulpy substance pass down with great facility, and, at the same time, affords a sheath against irritating food: the aliment is brought into this state by the operation of mastication in the mouth: after having been reduced into small parts by the teeth, it mixes with the saliva, forming a soft mass; it then descends into the stomach, and there undergoes the first operation of digestion, by means of the action of the gastric fluid, (which has been spoken of before, when upon the subject of digestion:) here it is changed into an insipid ash coloured substance. Having undergone the operation of the gastric menstruum, it passes through the pylorus into the duodenum, there to undergo the operation of chylication, which is continually absorbed by the lacteals.

Here,

Here, then, the digesting process is completed. After the lacteals have selected their food, there will remain the indegesta, or a residuum of the food which is incapable of digestion, and consequently of no use in nourishing the animal. The fæces contain a portion of bile, pancreatic juice, and the mucus of the intestines for the purpose of diluting them, and sheathing the coats of these tubes from the stimulant and irritating quality of the feculent matter.

The alimentary fæces of the human body are most generally of a yellowish bilious colour, and of a soft texture, upon its arrival into the large intestines; there the process of absorption still goes on, and becomes more complete here than in the smaller intestines, from the slower motion of these intestines; and during the stay of the fæces, the putrefactive fermentation begins to take place; as is evident from the foetid odour of them when evacuated during the healthy state of the body. They are, after the second absorption, thrown out of the body by means of the peristaltic motion of the intestines, together with the pressure of the diaphragm and the abdominal muscles. The peristaltic motion is occasioned by the fæces accumulating and irritating the intestines, and by the stimulant qualities of the bile acting upon the muscles of these tubes. I need not make any remarks upon the necessity of the feculent matter being evacuated from the intestines, as their retention would greatly affect the health of the animal, and be productive of the most serious consequences.

SECT. VI. *An Examination of the feculent Matter of the large Intestines.*

ON examining the feculent matter of the large intestines, we are necessarily led to consider, in the first place, the absorption of the more fluid parts of the fæces. The cœcum
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and the colon, the two first of the large intestines, are, like the smaller, supplied with absorbing vessels,* to take up the nutrient parts of the food, which are not completely absorbed from the feculent matter in the smaller canal, by means of the rapid motion of the contents of this tube; it was therefore necessary, that, in some part of the canal, a slower motion should take place, so that no part of the nourishment of the animal should be lost: in order, therefore, to fulfil this grand object, nature has provided the two large intestines with valves, by which means this intention is completely answered.

In this part of the intestinal canal, after the absorption of the fluidity of the fæces, a certain degree of putrefaction takes place in the dregs of the aliment themselves, from the length of time that they are retained there to accomplish an intire absorption of the nutrient parts: this is evident from the quantity of gaseous fluid which is emitted from the rectum: these airs are found to be those which are produced during the decomposition of animal and vegetable substances. The necessary promoters of putrefaction being present in these tubes in sufficient abundance to produce this effect, (air, heat and moisture being continually present) there can be no doubt of this process going forward in this canal; and further, the contents of these tubes being composed of such materials as undergo this process with great facility; nay, in their inanimate state they have a great tendency to burst forth from their compound to their elementary principles; for the living principle is, no doubt, the powerful agent in keeping those refractory companions from dissolving their confederacy: therefore, as long as bodies possess the living principle, so long will they resist the putrefactive process. That the fæces do undergo the putrefactive fermentation in the alimentary canal will further appear from the effect which takes place out of the body under similar circumstances. Putrefaction will take place out of the system in a degree of heat much less than that of the human body; and experiments shew, that putrefaction

* Vaughan's Anat. vol. i. p. 417.

faction goes on more rapidly in a confined place, than where the substances undergoing putrefaction are exposed to a free and more open situation. The extreme foetor of the fæces is owing to this state of them; hence, then, will it be easily to account for the extreme foetid and nauseous smell of the stools of dysenteric patients, together with an experiment which will be related hereafter, why this phenomenon ought to take place. We have shewn that putrefaction does take place in the fæces; it now remains to shew, that, during their decomposition a combination of septon with oxygene is formed. The putrefaction of substances is the decomposition of their organic structure, and an arrangement of them into new combinations, according to their relative attractions; the septon (azote) having a great attraction for oxygene, they will unite and form the septic (nitric) acid. This process will continue if the degree of heat is not so great as to change these ingredients into an elastic aerial form. Now, then, the septic (nitric) acid, uniting with the fæces, will contribute to produce their nauseous and foetid smell. This seems to be proved from the experiments of Pringle;* he united the nitrous (septous) acid to the fæces, in order to prove that it would take off that disagreeable smell which they possessed, but he found that instead of making them less foetid, it greatly increased the foetor of them.

The fæces sometimes put on an indurated form, which is certainly owing to the feculent matter remaining stagnant too long, by which means they lose their fluidity through the activity of the absorbing vessels, which are never at rest as long as they have any matter to take up: they have been found even to take part of the fæces.

This state of the alimentary canal is produced by a weak and lax state of the muscular fibres of the guts, they having lost their irritability from the too long continuance of the stimulus of distention.

Scybala

* Vide Pringle on the Diseases of the Army, p. 339.

Scybala are also frequently found in the intestines, from their contents becoming acrid, forming an excess of stimulus, which, operating upon their muscular fibres, produce a convulsive affection in these muscles, and occasion an irregular motion in them, whereby the fæces become formed into these scybala, or round balls. From their mechanical operation upon the intestines and the mouths of the blood vessels, these are irritated to such a degree, that, when evacuations are produced, some blood is frequently discharged with them; whence, and from the tenesmus, prolapsus ani and hæmorrhoids are produced. These scybala have, for a long time, been considered as the cause of dysenteric affections; but, since the doctrine of contagion lately published by MITCHILL, Professor of Chemistry, Natural History and Agriculture in Columbia College, the cause of this disease, as well as all those which come under the common denomination of fever, is much more satisfactorily accounted for, nay, it is reduced to a certainty. We have seen that putrefaction does take place in the fæces: this process of decomposition in the alimentary canal forms a new combination between the elementary parts: the oxygene and the septon (azote) unite to form the septic (nitric) acid, the carbone and hydrogen to form fat, the hydrogen and oxygene to form water, the oxygene and carbone, together with the matter of heat, to form carbonic acid gas, and the septon (azote) and hydrogen to form the volatile alkali. These are sometimes the product of putrefaction, but most generally the septic (nitric) acid is formed.

This chemical union of septon (azote) with the principle of acidity (oxygene) forms a very active fluid, which, coming in contact with the intestinal tubes, produces inflammation and excoriation. This corroding fluid is the cause of the vast quantities of blood which is voided by some dysenteric patients, from its destructive quality acting upon the blood vessels: it is so very active, that, during the time of evacuation, the

the anus will become excoriated. If the action of this deleterious fluid be suffered to remain, gangrene and all its concomitant evil will follow. This matter of contagion will enter the mass of blood, and produce that constant attendant on this disease, called the dysenteric fever. How this pestilential fluid should get into the blood will be easily understood: its miscibility with watery fluids enables it to be taken up by the absorbent vessels, and pass with the chyle into the circulating mass. But this disease does very frequently originate from a pestilential state of the atmosphere, and from the poison taken in with the drink, and mixing with the saliva, and by the absorbing vessels on the surface of the body: if to these external causes be added those produced or generated in the intestines, the violence of the disease will be increased. The appearances of the blood are also very remarkable: there is a large proportion of serum, of a yellowish green colour; the blood is of a dark colour; the right ventricle of the heart is generally filled with blood of a more fluid consistence than the left, the left ventricle is found nearly empty with polypi. The pestilential matter circulating with the blood operating upon the heart, by its stimulating power wears out the excitability, and produces death, by indirect debility. This is evident from the state of the pulse; in the beginning of the disease the pulse is hard and full, as it ought to be from the operation of stimuli upon the heart; but, as the disease proceeds, the pulse grows smaller and weaker, and begins to intermit, until death is ushered in to close the scene: this will take place in proportion to the virulency of the infectious matter, and also in proportion to the degree of excitability in the heart.

In weak and emaciated bodies, another state of disease in the alimentary canal is produced. Costiveness is generally occasioned by an impaired or weakened digestion. When this is the case, all the secreting organs will be more or less affected. The bile, which is a great assistant in digestion, being in less proportion than in health, the intestinal tubes
lose

lose a powerful stimulus. This state of the bowels is always found in persons addicted to spirituous liquors, and more especially in those whose occupations oblige them to lead sedentary lives: on this account we find that the female sex, whose daily employments are such as compel them to this kind of life, are more frequently afflicted with this habit of body than men, whose avocations are of a more active nature. This state of the bowels may proceed either from direct debility, from its usual stimulus being subducted, or of the indirect kind, from an excess of stimulus. From this view of the different appearances which the alimentary canal exhibits, it must be evident in what a variety of ways they are liable to be acted upon by certain causes; and, consequently, the variety of diseases which are produced for want of proper attention to these functions of the intestines. How very necessary, then, is it for the preservation of health, to attend to this part of the animal œconomy! and how very much will the success of the practitioner depend upon the care which he bestows on these circumstances, in keeping the alimentary organs in their healthy operation!

SECT. VII. *An Inquiry how far Animal Diet is capable of imparting to the Fæces the Power of exciting Dysenteric Symptoms.*

HOW far animal diet possesses qualities capable of exciting dysenteric symptoms, or to what degree this quality is inherent in animal food, I shall, in this place, endeavour to shew.—When I make use of the term animal diet, I wish to be understood as meaning the lean part, and not the fat, as this latter substance does not possess the dysenteric quality, from its containing no septon in its composition, but consists chiefly of carbone and hydrogen. In order to establish this position, it will be necessary to take a view of the muscular fibres re-
duced

duced to their elementary principles, viz. septon (azote), carbone, hydrogene, oxygene, a small proportion of sulphur and phosphorus. Here, then, is found, in the composition of the lean part of animals, the two substances which, when combined, form the pestilential fluid. Septon (azote) is found to exist in a very large proportion, and the oxygene in no small quantity. During the ordinary process of spontaneous decomposition, they combine together with great facility and eagerness. It may be asked, however, how it happens that these substances do not remain, after their resolution in their simple uncombined state? This is a wise law in the œconomy of nature, that, during the decomposition of bodies, there shall be between certain principles a strong predilection to unite and form new compounds; in this manner to prevent the waste of those parts. Now, so great is the disposition of septon (azote) to combine with the principle of acidity (oxygene), if the heat be properly proportioned, that they instantly, on being free, rush together, and form a chemical union, which produces the septic (nitric) acid. Nay, such is the desire or predisposition of septon (azote) to combine with oxygene, that, in the form of septous gas and acid, it will absorb it with avidity from the atmosphere until it becomes saturated with the principle of acidity.

That the decomposition whereby this combination is formed does take place in the alimentary canal, has been shewn in sect. 6; and that the acid is formed during the decomposition of animal substances, will appear from the use to which substances, when undergoing the putrefactive process, are put by the manufacturers of the septic of pot-ash, (nitre). Hence, then, it is evident why this disease is of so frequent occurrence in armies and on board of ships of war, where the chief diet of the soldiery is meat, and that not of the best kind; for it is a well established fact, that meat cured with salt to keep it from becoming putrid, is more or less tainted in that season of the year when this disease is most frequent among the com-

mon soldiers. The concocting process of these men becomes debilitated, from the fatigue and hardships to which they are exposed, together with the too free use of spirituous liquors : from this debilitated state of the organ of digestion, the food remains in the stomach unconcocted, putrefaction takes place, and in this state it is sent forth into the intestinal tubes ; but, from the quick motions of the small intestines, it is prevented from producing any bad effects there, and it is with rapidity sent to the large intestines ; there, by means of the slow motion which these parts are endowed with, the putrid mass remains stagnant for a time, and the putrid fermentation takes place with great rapidity ; and during the process, this pestilential fluid is formed, and continues to receive additions as long as there remains matter to undergo this ferment. Further, that animal diet is capable of imparting this deleterious quality to the fæces, is proved from what happens to persons in different grades in the army ; for, during the time this disease is found among the soldiers, the officers are rarely attacked with it. This, then, is just as it ought to be, agreeably to the doctrine I have been endeavouring to establish ; that persons, from their peculiar situations, should be more subject to a visitation of this disease than others, according to their ability of procuring the necessaries of life. The officer, from his situation, is not so much exposed to those causes which have a tendency to impair or interrupt digestion, as the common soldier, who is exposed to the vicissitudes and inclemency of the weather ; consequently, if he does not lead a debauched or irregular life, the concocting organs will digest the food with great alacrity, and thereby prevent putrefaction. Officers have it also in their power, from the high wages they receive, to procure and select the best provisions ; they likewise make more use of vegetables ; and while they have their tables served with fresh meats, the soldiers are obliged to eat those provided by their country, which, in the season of the year when this disease is most prevalent, is more
or

or less advanced to the first stages of putrefaction. Besides animal food there are also some of the vegetable productions which contain this deleterious substance, particularly wheat, but in a less degree than meat, and yet considerably more than the vegetables in general, though they all contain more or less of this principle. For wheat-flour, being frequently washed and suffered to pass through a strainer, will leave behind a gelatinous matter, from which the volatile alkali (ammonia) may be produced: this substance is denominated vegeto animal gluten. Ammonia is found, from analysis, to be compounded of septon (azote) and hydrogene.* HOMBERG, a German chemist, found that the fæces of men fed upon coarse bread contained a *salt*, which, when exposed to fire, detonated like nitre. GARDINER observes, that persons who were convalescent, and who had been attacked with dysentery or intermitting fever, on eating animal food had a relapse.†

SECT. VIII. *A Chemical Analysis of the Fæces.*

AFTER having examined how far animal diet is capable of imparting to the fæces qualities of exciting dysenteric symptoms, we are necessarily led to consider the qualities of the fæces, as appears from a chemical analysis, by their emitting *hydrogene gas, sulphurated hydrogen gas, phosphorated hydrogen gas, carbonic acid gas, and septous (azotic) gas.*

Hydrogene gas (inflammable air) is so great an ingredient in our daily nourishment, that this circumstance of itself is a sufficient evidence of its existence in the human body, but more especially in the intestinal canal; for it is a principal ingredient in water and spirits, and a portion of it is continually floating in the atmosphere; even meats contain a considerable part of the radical of this gas. Water is very readily decom-
pounded

* Fourcroy's Chemistry, vol. i. p. 339.

† On Animal Economy, p. 360.

pounded in a temperature less than that of the body of animals who breathe the common air of the atmosphere, and more especially if the animal be fed with flesh, and a degree of putrefaction takes place in the alimentary canal: the septon (azote) of the flesh having a greater attraction for the oxygene of the water than the hydrogene; consequently the oxygene and septon (azote) will, agreeable to the laws of elective attraction, unite and form the septic (nitric) acid, while the hydrogene will combine with the caloric of the water, and pass off in the form of hydrogene gas. That the septon (azote) has a greater attraction for the oxygene than the hydrogene, and consequently that it will decompose water, is evident from the phenomenon of lean meat, immersed in a running stream of water, being turned into fat; for the septon of the meat, uniting with the oxygene of the water, escapes in the form of septic (nitric) acid; while the hydrogene of the water, uniting with the carbone of the flesh, forms the carbonate of hydrogene, or fat.*

This gas has frequently manifested itself to persons engaged in dissecting human bodies in the night: in coming to open the abdomen, it has rushed out, and taken fire by the candle. Hydrogene gas is inflammable, burning with a pale blue flame; it has no sensible smell in its pure state. Flatus is frequently discharged from the intestines without any sensible smell. Air, thus emitted, has been found to burn by being brought into contact with an electric spark.

Sulphurated hydrogene gas is a frequent occurrence in the alimentary canal, even more so than the hydrogene gas itself; for it is a well established fact, that, if there be any sulphur in the neighbourhood of hydrogene, the sulphur will be dissolved by the hydrogene, and remain so even if the hydrogene be changed to the form of hydrogene gas, and form the sulphurated hydrogene gas. The sulphur is furnished by animal and vegetable substances taken as food. The impression
which

* Vide Gibbs's paper in the Repertory of Arts and Manufactures, vol. ii. p. 108 and 109.

which the flatus emitted per anum makes upon the olfactory nerves, corroborates this fact; it resembles the odour arising from putrid or rotten eggs, which is known to hold a quantity of sulphur in solution. The sulphur may be obtained from the atmosphere also, from the solubility of this substance in hydrogen gas, which, arising in and occupying the upper stratum of our atmosphere, from the hydrogen being specifically lighter than common air; and during a thunder-storm, the electric fluid coming in contact with this gas, it takes fire and burns; the sulphur is set loose, and is again precipitated to the earth; and during this time it may be taken into the stomach, and this sometimes may be one of the means of its origin. Phosphorated hydrogen gas is also sometimes found to exist in the intestinal tubes. The phosphorus enters into the composition of the bones of animals; for this substance, being united to the principle of acidity, forms the phosphoric acid, which, uniting with lime, forms the phosphate of lime or bones. This principle does also exist in animal substances, especially fish; for these animals, during putrefaction, will exhibit a shining appearance in the dark, like the brilliancy of a diamond; and it is also sometimes found in the fat part of animals. Vegetables likewise contain some of the phosphorus, as mustard, and all the plants belonging to the same class. During the decay of wood, this luminous appearance is very striking, and is a circumstance well known, and therefore needs only to be mentioned. The gas emitted, which has phosphorus in solution, will also be evident to those who have had an opportunity of smelling the peculiar odour of this substance, and can be easily distinguished from the sulphurated hydrogen gas. The disagreeable smell of the breath of persons whose teeth are decayed, is owing to this substance being set loose from its union with lime, which enters into combination to form the teeth. This peculiar smell of the teeth will enable us to determine whether the disagreeable smell of the gas emitted per anum, is owing to

to sulphur being dissolved in the hydrogen gas or phosphorus; for either the one or the other it must be to produce any sensible effect upon the olfactory nerves; for the hydrogen has no sensible smell in its simple state.

Carbonic acid gas is another fluid which is contained, in great abundance, in the alimentary canal. Carbone is one of the principal ingredients in our food; all the animal and vegetable substances contain this principle; these, undergoing decomposition, evolve this substance, which, combining with caloric, or the matter of heat, and the acidifiable principle, oxygene, forms this acid gas; for such is the attraction which carbone has for oxygene, that the former cannot be brought into the state of gas without its combination with the latter. This fluid also exists, in a small proportion, in the atmosphere, and it may be derived from this source by its mixing with our food, drink, and the saliva; and it may be carried with them, in this way, into the stomach. From the universality of this substance, and the great proportion of it which is daily taken into the system, there can no doubt remain of its existence in the intestinal tubes. It is also found, in great abundance, in drinks, which are very generally in use in this country, the fermented or malt liquors: from this source it may be considered as derived in the greatest quantity.

There is yet one other gaseous fluid which may exist in the alimentary canal; for it is one of the principal ingredients composing the food of those who make use of animal substances. It also exists, in a less proportion, in the composition of some vegetables. Septous (azotic) gas is produced from the decomposition of animal and vegetable substances; it is the principle of putrefaction. This substance takes on the form of an elastic fluid, or gas, in the ordinary temperature of our atmosphere. This gas is also one of the principal ingredients in composing our atmosphere, it being composed of $\frac{71}{100}$ of septous gas, $\frac{27}{100}$ of oxygene gas, and $\frac{2}{100}$ of carbonic acid gas. Here, then, may be a principal source whence this gas
may

may be derived; from the miscibility of the enumerated aerial fluids with water, saliva, and our diet, they may be carried along with them into the stomach. From these remarks, and the great abundance of some of these gases in the articles which are daily used, I am led to conclude, that all of them do more or less occur in the intestinal canal.

SECT. IX. *Arguments to prove that neither of those Gases have the Power of producing Dysentery.*

THAT hydrogen gas has no agency in producing this diseased state of the large intestines, will appear from the great use made of substances which have this principle for its basis, and which make chiefly the fluid parts of our aliment; and from the frequent occurrence of this gas. We shall next see, that this gas, combined with other substances, will be nearly as inoffensive as in its simple form. In combining carbone with its basis, hydrogen, a very mild and nourishing compound is formed, one that is greatly in use as an article of diet. This compound is fat, which no person will contend to be deleterious to the constitution, but contributes greatly to nourish the animal. In combining hydrogen and oxygene, we shall have water formed, which is much used as a drink. Hydrogene and septon (azote), when united, form the volatile alkali (ammonia). This is used, in medicine, with great success in some diseases, and given in large quantities, without dysentery ever occurring from its liberal use. Similar compounds will be formed with the combinations of the different elementary principles united to the sulphurated hydrogen gas, and the phosphorated hydrogen gas; with this difference, that the two latter will, in some of these compounds, especially when united with oxygene, have a quantity of sulphur in solution; while, in the others, the sulphur and phosphorus will be precipitated; and these two ingredients, whether combined with

with the above principles or in a simple state, are equally innocent with the other, as they are found in the body in a combined state, with some one or all of the above principles.

In the same manner is the carbonic acid gas equally innocent with the hydrogen gas, it being always present in the animal constitution: it is emitted from the lungs in large proportions during expiration; and the frequency of its occurrence in the alimentary canal, without producing this sort of sickness, is a sufficient fact to prove that this cannot be the cause of the disease. In its combination with other substances it will be found equally inoffensive.—Further, it is well known, that at present it is considered a very valuable remedy in certain diseases, and prescribed in large doses; as is evinced by the late discoveries and experience of BEDDOES, and other pneumatic physicians; which is a strong corroboration of the reasoning deduced, that the carbonic acid gas is incapable of exciting dysenteric symptoms.

Septous gas is also as incapable of producing dysentery as any of the other gases: it is continually present, in some degree, in the alimentary canal: being one of the most abundant ingredients in the atmosphere, it finds its way into the stomach and intestines by mixing with the food, water and saliva; and, consequently, if this gas was the cause of the disease, the human system would never be without an affection of the large intestines.—I have given a combination of the principles which are the basis of the different gases enumerated, as found to exist in the alimentary canal, in order to shew that these combined possess no qualities more deleterious to animals, than in their simple state, or that of gas: but these substances never combine together after they are united with caloric (or matter of heat) to form new compounds, on account of the repelling power of caloric, which is continually operating in opposition to the power of attraction; therefore they cannot come in contact with each other to form these compounds according to the laws of affinity or elective attraction.

CHAP. II. *The Medical Consideration of the Subject.*

SECT. I. *The Cause producing Dysentery, and the Connection between this Disease and others shewn.*

HAVING shewn that the different gases found to exist in the alimentary canal are not the cause of dysentery, we further have seen, that these, combined together according to the laws of affinity, are also incapable of exciting this diseased state of the large intestines. We shall next shew that septon (azote), combined with the principle of acidity (oxygene), is capable, and, moreover, is the only true cause of this disease. The facts, however, shewing that an acid is the cause of dysentery, are of the indirect kind: no experiment as yet has been made to ascertain the fact; though, from the analysis of matter taken in as food, producing an acid, under certain circumstances, and also excrements being used for the purpose of obtaining the acid for the formation of nitre (septite of potash), we are led to conclude that this is the case; and the same operation which produces this acid out of the body, is found frequently to take place in the intestinal tubes.—PRINGLE positively declares, that an acid exists in the fæces, which he calls “the feculent acid.”* The septous acid, on being united with the fæces, instead of allaying the foetor, increased it, contrary to the expectation of the experimenter.† This acid is called, by him and other writers, the mineral acid.‡ Hence the increased foetor of the stools of patients in this disease; and hence also a strong proof that the acid of septon is the cause of this disease. From the analogy of the food made use of by the human species, it is found to contain the basis

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* Diseases of the Army. Appendix, p. 385.

† Pringle, p. 339.

‡ The septous (nitrous) acid has, for a long time, been supposed to be a mineral production, but has lately been found to be of animal and vegetable origin, produced by putrefaction.

of this acid in a large proportion, for animal diet is much more used than vegetables among that part of the human species which suffers most from dysentery. The fæces of a man fed upon coarse bread has been found to contain a salt, that detonated like nitre, when exposed to fire, as made by HOMBERG. MACQUER,* in his remarks on HOMBERG's experiment, says, "that its nitrous character is by no means ambiguous: its deflagrating on live coals convinced Mr. HOMBERG of its being nitre. But its constantly taking fire in the retort, as often as distilled, is a sure proof that it is a nitrous salt."

This also is a certain fact, and one in point, to prove that the septic acid is produced or generated in the alimentary canal; and also proves the great use of the bile in preventing those diseases, by saturating the acid with the alkali, and thereby preventing the mischief which would otherwise have been the consequence.

The septic (nitric) acid formed in the alimentary canal, in this experiment, is saturated by the mineral alkali of the bile forming the septite (nitrite) of soda. If, then, this acid is produced in the alimentary canal of a man fed upon bread, in what greater proportion ought it to be found in those who are fed upon lean or muscular animal matter, which contains the basis of this acid in a greater proportion than bread or corn! There is no doubt but this acid is more or less constantly formed in the intestinal tube, as proved by the experiment of HOMBERG; the alkali contained in the bile being in sufficient quantity to neutralize and form a septic (nitric) salt.

MASSEY,† in his paper on salt-petre, declares, that the strongest septic (nitric) acid is formed in the ponds and tanks, or shallow ponds of water, in the East-Indies, by the spontaneous decomposition of animal and vegetable matter in those tanks or ponds. Animal substances, says PRINGLE,‡ will putrefy

* Chemistry, vol. ii. p. 372.

† Vide Repertory of Arts and Manufactures, vol. i. p. 322.

‡ Diseases of the Army, p. 339.

putrefy quicker in a confined than in a free air. MASSEY* further asserts, that the putrefaction of manures, stinking pits and ditches, produce the nitric acid. Having proved that an acid exists in the alimentary canal, and that this is the septic (nitric) acid, I shall shew from what other sources this acid is derived besides being generated in that canal.

Having established the fact, that an acid is formed in the intestinal canal, and that this is the septic (nitric), it will appear evident, from thence, how it comes to pass that this disease is produced, while no cause from without the body can be discovered, and especially in that season when a few sporadic cases are met with. It does not follow from hence, that all the dysenteries arise from an internal cause; but a much greater proportion proceeds from the gaseous oxyd and volatile acid of septon (azote), taken in the body from without. In an atmosphere that is incumbered with pestilential fluids, these may affect the system of such persons as are exposed to their operation by entering in the pulmonic organs, there mixing with the blood, and exerting its influence on the heart; and as the blood passes in its routine of circulation, give to the contents of the alimentary canal a part of its deleterious quality, or may be taken into the stomach during the time of our meals, and be swallowed with the food. From their miscibility with water and fluids in general, the saliva becomes another mode of carrying it into the alimentary canal; and lastly, it is absorbed from the atmosphere by the numerous absorbing vessels spread over the whole surface of the body, in the same manner as mercury and other substances are taken up by these vessels, when applied to the skin. From these different modes in which pestilence penetrates the body, it will appear what vast quantities of the matter of contagion may be taken in, and why it happens that the patient is so frequently attacked in the space of a few hours after being exposed to such air; provided that the atmosphere which he breathes be highly

* Vide Repertory of Arts and Manufactures, vol. i. p. 32r.

ly charged with the matter of contagion. It is owing to pestilence, also, that a fever is produced, which is termed dysenteric fever: so strong is the connection of fever with dysentery, that it is reckoned a necessary symptom by writers on this disease; but a dysentery, or, at least, the affection of the large intestines, which, when united with fever, is called dysentery, may exist, for a short time, without fever: this, however, is only in sporadic cases, where there is no vitiated state of the atmosphere: but so quick is the absorption of this fluid from the large intestines, that it is taken into the circulation, and, operating upon the heart and arteries, produces that particular action of the sanguiferous system termed fever, almost as quick as the operation of its effect upon the alimentary canal. On the contrary, the fever may exist previous to any affection of the large intestines, provided the exciting cause be taken to the blood vessels by the pulmonic organ, and, through means of the blood, impart it to the large intestines.

Marsh-miasmata have, for a long time, been considered as the cause of this distemper, together with putrid fumes. Let us consider what these causes are, and wherein they differ. Marsh-miasmata are the fumes arising from swampy and marshy soils, wherein are found vast quantities of frogs, newts, insects, and other animals of the like kind, together with vegetable substances, which are continually undergoing spontaneous decomposition by putrefaction: these impart to the water and soil a strong septic (nitric) tincture, which, evaporating by the heat of the season, imparts its deleterious quality to the atmosphere, where it floats, and is wafted by the wind in every direction, and affects such persons as are in its neighbourhood. This will appear the more certain by a fact taken from MASSEY:* his words are—"But it must not be forgotten, that their [speaking of the East-Indies] strongest nitrous (septous) earths are found at the bottom of their tanks and shallow ponds of water, which, in that country, are
" often

* Vide Repertory of Arts and Manufactures, vol. i, p. 323.

“ often of great extent, and in which, the water being eva-
 “ porated by the heat of the sun, large quantities of fish are
 “ left to corrupt, which furnishes a mud of the *strongest ni-*
 “ *trous* (septous) *quality*.” Hence marsh-miasmata, or the
 fumes arising from marshes, are nothing but the gaseous oxyd
 of septon (azote), and septic acid gas; and the dysentery pro-
 duced by marsh-miasmata is, consequently, owing to the septic
 (nitric) quality of the water with which it is made to exhale
 by heat; for, the evaporation of the pure water certainly
 would not have the same effect, as there is nothing deleterious
 in this fluid. PRINGLE* says, “ the intermitting fever, cho-
 “ lera, and dysentery, may as properly be called the endemics
 “ of camps as of low and *marshy* countries.”

Fumes from corrupting animal and vegetable substances are
 another cause capable of producing dysentery, and as such are
 enumerated by some authors. Let us also examine what pu-
 trid vapours are, and wherein they differ from marsh-miasmata.
 The product of putrefaction has been fully stated [in sect. 7]
 to be the formation of certain new compounds, from decay-
 ing organic matter. The oxygene and septon (azote), com-
 bining during this process, form the septic (nitric) acid. “ Pu-
 “ trid juices and vapours are dispersed through the earth and
 “ air, so that there are few earths, of an absorbent kind, that
 “ are not, in some degree, nitrous.”† All these septic vapours
 which are enumerated, and which have been supposed to be
 of different kinds, are capable of producing dysentery, and are
 in reality similar; excepting, that, in the one, this pestilential
 fluid is formed in low and marshy situations, while the other
 undergoes the same process in any situation favourable to pu-
 trefaction. Dysentery may arise from two causes; from acri-
 mony generated in the body, and from putrid steams. “ A
 “ remarkable case occurred to me, of a person seized with
 “ dysentery, upon smelling of human blood become putrid
 “ by

* Diseases of the Army, p. 10.

† Vide Repertory of Arts and Manufactures, vol. i. p. 324 & seq.

“by standing some months in a close phial.”* Now, it is known, that the vapours of putrid blood, attracted by chalk, form calcarious nitre, and are consequently of a septic nature. How far, and what agency or qualities animal diet possesses capable of exciting this disease of the large intestines, has already been shewn in sect. 7. I intended to have shewn further, that it possessed, in some degree, this quality, by comparing the diseases of the inferior order of animals with those of the human species; but the diseases of the domestic, as well as those of wild animals, are as yet hidden behind the curtain of obscurity. No person has considered it of much moment to note the diseases incident to brutes, not even those of that majestic and useful animal the horse. I trust, however, that when we come to pay more attention to the diseases of the brute creation, we shall find that those who make use of such diet as contains septon, whether animal or vegetable, will be found to be subject to this disease, and to all the other distempers arising from the same general cause.

SECT. II. *The Effects of Pestilential Fluids upon the Mesentery and its Glands.*

BESIDES the affection of the large intestines, by the operation of pestilential fluids, other parts in the neighbourhood of them will be liable to become diseased by its influence. The parts that are most frequently affected by them, will be the mesentery and its glands, as the deleterious fluid will be more immediately applied to them by means of absorption. The septic (nitric) compounds, passing through the lymphatic vessels, produce a degree of inflammation, which will be communicated to those glands through which they pass in their course to the thoracic duct, and excite in them an inflammatory action, which will induce a schirrous or indurated state of

* Pringle on the Diseases of the Army, p. 227.

of them. It is also frequently communicated to the whole of the mesentery, as appears from the dissection of a person who has died of dysentery.* That this matter of contagion is absorbed by these vessels, is evident from the production of fever in sporadic cases of dysentery; for the matter of pestilence, being first produced or generated in the large intestines, is afterwards absorbed and carried into the blood vessels, and, by the operation of its stimulus, occasions an increased action of the heart and arteries.

The wasting of the body, called marasmus, which sometimes takes place in this and other similar diseases, depending upon pestilential vapours for their cause, can also be explained upon the same principle. As the glands become indurated by the application of these septic (nitric) combinations to them, it will appear evident, that, during the operation of the matter of contagion upon them, the chyle will be in some measure obstructed in its circulation through these glands, and, consequently, the body will not receive its accustomed quantity of nourishment, or what is adequate to the quantity wasted in the performance of its healthy functions: the natural conclusion, therefore, will be, that the body must waste away, and occasion the phenomenon of the disease termed marasmus.—Further, it will appear evident, that this state of the mesenteric glands does take place, by comparing them with the effect which pestilential fluids are known to have upon the glands which come more immediately under our view. The axillary and inguinal glands we know to be operated upon in this manner, by these vapours: for it is a well authenticated fact, that induration of the axillary and inguinal glands takes place in the plague, small-pox, and all the other diseases produced from an highly concentrated pestilential state of the atmosphere. The absorbent vessels are capable of being traced from the part where this deleterious fluid has been applied, quite to their termination into these glands. As a further corroboration

* Vide sect. 3, on Dissections.

roboration of what has been said, it will appear, from the similar effects which are sometimes found in the glands contained in the intestines, for the purpose of secreting a fluid for the lubrication of them, that they are found to be indurated, or schirrous, in persons who have died of the dysentery.*

These remarks will be further confirmed by the frequent dropfical affections which follow long-continued dysenteries, intermittent fevers, and all the other diseases produced by the same cause. The obstruction of these glands is, in many instances, the cause of dropfy; for the lymph, being incapable of passing through these glands, is deposited in the different cavities and cellular textures of the body producing the phenomenon of this malady; and the generality or locality of the disease will be in proportion to the universality of the obstruction. That dropfies are frequently occasioned by a schirrous state of the mesenteric glands, will appear from the observations of BROOKS.† Intermittent fevers also sometimes produce a schirrous or indurated state of the viscera, as appears from the remarks of the Baron VAN SWIETEN.‡ Dyfentery, says M'BRIDE, changes frequently to a serous diarrhœa.§ The diarrhœa following dysentery depends, no doubt, upon an obstruction of the mesenteric glands, occasioned by the inflammation excited by the pestilential fluid, which prevents the lymph of the intestines from being deposited in the receptaculum chyli, and causes this serous fluid to pass off by the bowels, and produce what the authors above-named call a serous diarrhœa. That this is the case appears from the observations of BROOKS,|| that diarrhœa is produced from a stimulus which irritates the viscera, occasioning the expulsion of their fluids from the vessels of the liver, pancreas, mesentery, and intestines: when, at the same time, the mouths of the mesenteric

* Vide sect. 3. chap. 2.

† Practice of Physic, vol. i. p. 301.

‡ Vol. vii. p. 198.

§ M'Bride's Practice of Physic, vol. ii. p. 233.

|| Practice of Physic, vol. i. p. 340.

mesenteric veins and the lacteals are obstructed. This author further adds, that dropries are produced by a long-continued lenterious dysentery, and schirrous of the mesentery.* Hence, then, it appears, from the above consideration, that an obstruction of the mesenteric glands may take place in a long-continued case of dysentery, and other diseases depending upon the septic (nitric) compounds for their exciting cause.

SECT. III. *The Appearances from Dissection.*

THIS is further confirmed from the appearance, on dissection, of patients who had died of dysentery. This disease always manifests itself in the large intestines, but most generally the colon and rectum are only affected; they have a black and putrid appearance; the coats are preternaturally enlarged, much ulcerated on the inside, and gangrenous; the villous coats are either wholly abraded, or changed into a corrupted and slimy substance, of a greenish colour. The stomach and small intestines are neither mortified, nor discoloured: sometimes, however, they are distended with air. The mesentery is also affected, especially the glands; so is the omentum, which puts on a greenish colour. The liver has been found to be affected; but this is a very rare occurrence. The bile is sometimes found to be ropy, thick, and of a dark hue. That part of the vena cava ascendens which lies upon the vertebræ, is also affected, and is very tender. The spleen has also been found affected.

PRINGLE† found the large intestines ulcerated, black, and putrid; the heart in this patient contained clotted blood: the blood in the vessels was fluid, but of a blackish colour; while the stomach and small intestines were found in a healthy state.

H

RICHTER

* Brooks's Practice of Physic, vol. i. p. 301.

† On the Diseases of the Army, p. 227.

RICHTER* observes, in giving an account of the dissection of a young lady who died of a dysenteric affection, that he found the large intestines gangrenous.

HOFFMAN† found, on dissecting dysenteric patients, that the large intestines were deprived of their villous coat; that they were inflamed, ulcerated, and mortified.

DONALD MONRO never has seen similar erosions of the villous coats of the small intestines in any of the bodies of those who died with dysenteries.‡

CLEGHORN, in his observations on the diseases of the Island of Minorca, treating of dysentery, says, “upon opening
“the bodies of the dead, I have constantly found the great
“guts either entirely mortified, partly inflamed, or partly
“mortified: in many I have seen schirrous tubercles strait-
“ening the cavity of the colon in several places; in a few
“there were small abscesses in the cellular membrane of the
“peritonæum, contiguous to the colon and rectum; sometimes
“the small guts were perfectly sound in appearance, but more
“frequently the lower part was inflamed, the convolutions
“being often preternaturally connected to each other by
“membranes, as the lungs sometimes are to the pleura. In
“two people the omentum was almost entirely wasted, the
“small remains of it being quite black; while purulent wa-
“ter was found in the cavity of the abdomen. In several it
“was inflamed, and adhered both to the guts and peritonæum.
“For the most part the gall-bladder was full of dark bile,
“and the spleen more or less in a putrid condition.”§

PRINGLE|| gives an account of the dissections of the bodies of some patients who died of dysentery, which was epidemical, in London, in the fall of 1762, where, besides the common appearance of the rectum and colon, he observed,
on

* Medical Observations, p. 103.

† Practice of Medicine, p. 176.

‡ Diseases of the Army, vol. i. p. 330.

§ Cleghorn, p. 227.

|| Diseases of the Army, p. 251.

on the inside of the lower part of the colon, and the upper part of the rectum, a number of small tubercles or excrescences, which resembled the small-pox, of a flat sort, differing from them in this, that they were of a firm consistence, and without any cavity.

From these appearances of the contents of the abdomen, we find that the colon and rectum are the seat of this disease, as they were always found to be diseased, while the other parts in their neighbourhood remained sound; yet, we find, that sometimes, however, the parts near them are affected; and it is what we ought to expect, from the nature of pestilential fluids spreading, in the more malignant form, through a great part of the contents of the abdomen; consequently we find it to affect the lower part of the small intestines, the omentum, liver, gall-bladder, spleen, stomach, peritonæum, and the mesentery, and producing in them similar appearances with those of the original seat of the disease.

SECT. IV. *A View of the Connection of Dysentery with the Intermitting and Remitting Fever.*

THIS principle is further confirmed, from the connection between dysentery and the intermitting and remitting fever. That there should be such an intimate connection between those diseases, is evident from the similarity of the causes producing them. It has been proved that dysentery arises from marsh-miasmata and putrid vapours: these two causes have also been shewn to be the same; producing, when collected or condensed, the septic (nitric) acid. The intermitting fever is also produced by these causes, as is also the remitting. Hence, then, it follows, that these diseases arise from the putrefaction of animal and vegetable substances, producing, by this spontaneous decomposition, pestilence (the gaseous oxyd and acid of septon). The pestilential fluids being so abundant, in nature, produced from the resolution of animal and vegetable

table matters into new combinations, by means of the putrefactive fermentation, that it is easily accounting for the frequency of these diseases, and especially in camps, ships of war, and transports, where great numbers of people are crowded together, and many corrupting materials are accumulated, by reason of the filth and nastiness incident to such situations, through negligence of their commanders and owners; and to these being also united the effluvia arising from each other.

WADE* is of opinion, that fevers and dysentery are ailments of a kindred nature, prevented and cured in the same manner; and that they do, in every case, arise, in those climates, from the bowels and their contents.

GARDINER† observes, that marshy and fenny grounds emit the greatest abundance of this miasma, from the immense quantity of animal and vegetable matter, which is continually undergoing decomposition, and which, consequently, emits large portions of putrid exhalations; the activity of which is increased in proportion to the quantity or degree of putrefaction.

HUNTER‡ observed, that the dysentery and remitting fever ran into each other, from the similarity of the causes producing them, in Jamaica.

PRINGLE§ observed, that intermitting, or marsh fevers, during the warm season, were very apt to put on a double form or paroxysm, or to change into a continued form, rather than to remain in the intermitting shape: he also found the putrid and contagious fevers changing into dysentery.

But marsh-miasmata are not the only cause of these diseases, says GARDINER:¶ they are also found to be produced in jails, hospitals and ships; and also in private families, especially

* On the Diseases of the East-Indies, p. 130.

† Animal Economy, p. 18.

‡ Medical Commentaries, vol. xiii. p. 195.

§ Diseases of the Army, p. 210, 211.

¶ Animal Economy, p. 185.

cially among people of the poorer class. This strongly proves the similarity of the marsh-miasmata to the human or putrid vapours which are constantly exhaling from the bodies of men who do not pay proper attention to the cleanliness of their persons; they both producing the same effect, as appears from the respectable authority just quoted.

ZIMMERMAN,* in his description of the dysentery in Switzerland, in 1765, observes, that there existed a great connection between dysentery and putrid fevers.

SAUNDERS† found a relation between the bilious yellow fever, intermitting, and the bloody-flux.

Several cases, during the last season, appeared in the New-York hospital, of dysentery changing into the intermitting fever, and the intermitting fever changing into dysentery. In the one, a person came into this institution, with an intermitting fever; after a few days it changed into a dysentery; and two or three days after, it again changed into the intermitting; and continued to alternate, in this manner, two or three times, when he became cured. The others were persons who had contracted dysentery in the house from the privy, as was supposed by the attending physicians,‡ (after they were convalescent from other diseases). The dysentery changed into the intermitting, and, as before, changed again into dysentery; from which affection they were cured.

JACKSON§ observed, that, in the first stages of the yellow fever, symptoms occurred which would lead the physician to conclude that it was a dysenteric affection.

JOHN MILLER|| considers dysentery as only a more malignant remitting fever.

It appears from GARDINER's¶ treatise on bilious remitting and

* In his Treatise on Dysentery, chap. 2.

† Medical Commentaries, vol. vi. p. 511.

‡ Mitchill and E. H. Smith.

§ Fevers of Jamaica, p. 179.

|| Vide Bird on the Army, p. 285.

¶ Animal Economy, p. 335.

and intermitting fevers, that he supposes them to be produced by the same cause, only differing in the virulence of the contagious matter producing them. He observes, in speaking of the bilious remitting and intermitting fevers, that the different forms in which these diseases shew themselves, in encampments, are those of the most malignant kind; they are quotidian, tertians, quartans, diarrhœas, dysenteries, &c. This last is the most frequent in camps and military hospitals. This author further says,* that it is common for continued fevers to remit, intermit, and at last to end in dysentery.

CARMICHAEL SMITH† is of opinion, that all kinds of contagious fevers, as well as the jail, have their causes arising from the putrefaction of animal and vegetable substances.

The same author declares,‡ that fevers arising in consequence of exposure to putrid vapours or contagion, assume a variety of types and forms, according to the various combinations and degrees of putridity. From the slightest vernal intermittent to the true plague, are only different shades of the same disease, and are the production of one common cause, viz. putrefaction.

JOHN HUNTER,§ in his diseases of the army in Jamaica, says, “there subsists an intimate connection between the remitting fever and dysentery, in this island: the one frequently changes into the other, and the two diseases are often complicated with various degrees of violence. In some cases dysentery ends in the remitting fever; though it oftener happens that the fever terminates in dysentery.”

Dysentery, says REID,|| is so intimately connected with the remitting fever, that some late writers have supposed it the same. He further adds, that it arises from the same cause, and, according to his late mode of treating it, he used the same

* Animal Economy, p. 356.

† On Jail Fever, p. 40 & seq.

‡ P. 50—1.

§ P. 218.

|| Diseases of the Army, p. 50.

same remedies, and with success. Petechiæ are found in bad dysenteric cases, and some few have universal yellowness of the skin.

CLEGHORN* observes, that, from the great similitude there is, in many respects, between the tertian fever and the dysentery, he was induced to treat them in the same manner. He further adds,† “the tertian fever, cholera-morbus, rash, effere, “diarrhœa, and dysentery, are frequently epidemics; there “being a near alliance between all these diseases: these frequently put on tertian periods, and they change sometimes “in one and sometimes in the other: a tertian is sometimes “changed into a dysentery, and sometimes a dysentery changes “into a tertian; and when one of these diseases is suppressed, “the other often ensues.”

From these facts, then, it appears, that there is not only a great connection subsisting between the intermitting and remitting fevers, and dysentery, but also between this disease and the yellow fever of the West-Indies, which is the most malignant of any, except the plague. The plague is only a higher degree of the yellow fever. That it is produced by the same cause will appear from the description of the situation of Grand Cairo, the seminary of the plague.‡ “It is “situated in a sandy plain, at the foot of the mountain, which, “by keeping off the winds, that would refresh the air, makes “the heats very stifling. Through the midst of it passes a “canal, which is filled with water during the overflowing “of the river Nile; and after the river is decreased, it gradually dries up. Into this canal the people throw all kinds of “filth, *carrion*, &c. so that the stench arising from this, and “the mud together, is insufferable. In this posture of things, “the plague, every year, constantly preys upon the inhabitants, and is only stopt when the Nile, by overflowing, “washes away the load of filth.”

MEAD

* P. 255, 6.

† P. 134.

‡ Mead on the Plague, p. 29, 30.

MEAD* further observes, that, from putrefaction in these northern climates, we find sometimes very fatal distempers, though they do not rise to the malignity of the plague; and such fevers are often bred where a large number of people are closely confined together, as in jails, sieges, and camps. Hence, then, it is evident, that all the grades of fever, from the intermitting up to the plague, arise from the same cause; and that this cause is contagion, produced from the putrefaction of animal and vegetable matter; and that this is the volatile septic (nitric) oxyd and acid, as has been shewn before: and further, that there is a connection and intimacy between these fevers and dysentery; consequently dysentery is produced from the same cause. The septic (nitric) acid is the cause of these diseases; and according to the virulence and activity of this pestilential fluid, and the parts of the body to which it is applied, will depend the peculiar form of those diseases, as well as the malignancy of them; these diseases differing only as to the part exposed to the operation of this contagious matter, and also the degree of concentration and spissitude of the same pestilential fluid.

SECT. V. *An Examination whether and in what Manner the Dysentery, and Intermitting and Remitting Fevers, are infectious.*

IN considering the manner, and under what circumstances, the intermitting and remitting fevers, and dysentery, are infectious, it will only be necessary to shew, that if any one of them is so, it will be a necessary consequence that the others are capable of communication from one to the other, under similar circumstances, as they are all produced from the same cause, but differently modified. I shall shew, in the first place, that dysentery is infectious, as it has been a matter of great dispute,

* On the Plague, p. 33, 34.

dispute, for a long time, and has been warmly contested between the two parties engaged in this speculation. I do not undertake to side with either party, but will endeavour to evince that both are wrong, and that the truth lies between.

The dysentery may or may not be infectious: this, however, depends upon circumstances. If, for instance, a patient is kept in a pestilential atmosphere, as in that of most bed-chambers in which persons sick with diseases are; if it be not frequently changed, together with the linen and sheets; and if the discharges by stool, which are foetid, be suffered to remain in the room; and whenever cleanliness is neglected; under these circumstances this disease will be infectious. But, on the contrary, where every attention is paid to cleanliness, the room frequently changed, and ventilated; with a due regard to these circumstances, it will be found that it is not capable of being communicated from one to the other; and by this means it will be prevented from spreading to those who are necessarily obliged to be about the diseased person. The reason why this disease rages so violently in camps, and other places where a great number of persons are crowded together, is because of an inattention to cleanliness, and a proper care of removing all putrid substances from about their habitations: the disease is continually receiving additional quantities of this pestilential fluid from the exhalations from their bodies; to which may be added what is derived from their privies.

PRINGLE* found the camp dysentery always contagious when it appeared in the fall.

Baron VAN SWIETEN† relates a case where a physician, who was engaged in an examination of the stools of a dysenteric patient, fell ill with the disease himself, as also the person employed to wash the linen which had been dirtied by the stools.

ZIMMERMAN‡ informs us, that dysentery becomes infectious

* Diseases of the Army, p. 214.

† Vol. ix. p. 357 & seq.

‡ Vol. ii. p. 126.

tious by the extreme putridity of the stools; that the most healthy subjects, and even animals, are affected with it. This author further relates an account of a dysentery which had been brought from Amsterdam to Nimiguen, and from thence spread to fifty Dutch places, and carried off a great number of people. This disease, continues he, was so malignant at Bern, in 1768, that thirteen thousand died with it.*

PRINGLE† was a man whose opportunities were very great, while in the army, to make observations on this disease, and was also a very nice and accurate observer; and it is on this account that I refer my reader so often to his writings. He gives an account of the state of the sick while the army was in Hannau: there were about fifteen thousand persons sick; the greatest number were affected with dysentery, by which means the air became vitiated to such a degree, that not only the rest of the patients were attacked with this disease, but also the apothecaries, nurses, and attendants, with most of the inhabitants of this village.

These facts, taken from authors the most respectable in the profession, will, I trust, be sufficient to convince every candid reader, that this disease, under the circumstances which I have mentioned, will, to a certain degree, be infectious. On the contrary, where opposite circumstances exist, this disease will be found incapable of being communicated from the one to the other, as daily experience must evince: it will not be necessary, therefore, to produce proof to corroborate this, as it is a well known fact, that dysentery, attacking a patient whose situation in life is such that a proper attention can be had to keep his apartment clean, and every thing neat about him, rarely or never infects the attendants. What has been advanced with regard to dysentery, will hold good with the intermitting and remitting fevers. But, as it is generally supposed that the intermitting fever is not infectious, I shall produce

* Vol. ii. p. 127.

† P. 22.

produce an authority to prove that it is. CLEGHORN,* in his diseases of the Island of Minorca, says, “ tertians have as good a right to be called infectious, as the measles, or the small-pox.” That the fevers commonly remitting are also infectious, is a well established fact. That the remitting fever, of which kind the jail is considered, is infectious, will appear from the authority of MEAD.† “ Nothing (says this author) approaches so near the first origin of the plague, as air pent up, loaded with damps, and corrupted with the filthiness that proceeds from animal bodies. Our common prisons afford us an instance of something like this, where very few escape what they call the jail fever, which is always attended with a degree of malignity.”

I am aware of the arguments which those who do not believe these diseases capable of being communicated from the sick to those who are in a state of health, will use to maintain the position, that they are either epidemical or endemical from the pestilential state of the atmosphere; and that every person will be more or less liable to be affected with those diseases from this cause. I grant this to be the case generally. But will not the persons who attend and nurse the sick be more liable to be affected than those who are not conversant with them? I answer, yes, most certainly; and I am supported by the authority of CLEGHORN and FORDYCE, who both declare this to be the case; and this is easily reconciled; for there is always exhaling from the sick infectious effluvia, which in general may not be sufficient to produce the diseases; yet we are warranted to believe, that they may be sometimes capable of exciting these unhealthy states of the system.

SECT.

* P. 132.

† Mead on the Plague, 110, 111.

SECT. VI. *Of the Phenomena of Diseases arising sporadically, endemically, and epidemically.*

HAVING considered the connection subsisting between dysentery and the intermitting and remitting fevers, we are necessarily led to consider the phenomena of these diseases, as arising sporadically, endemically, and epidemically. Diseases are said to arise sporadically, when a few scattering cases of a particular disease is found to exist; the sporadic diseases, or their causes, are generally produced in the body or neighbourhood of the patient's habitation. Thus, when a dysentery is produced from the putrefaction of the contents of the alimentary canal, it is the cause of a sporadic affection. The matter produced by the putrefaction of animal and vegetable substances we have denominated the gaseous oxyd of septon (azote), if oxygenated to the half acid point; the septic (nitric) acid, if the acid be raised to a highly oxygenated state, by the addition of the principle of acidity. These may be produced in the body in the same manner as they are formed out of the system; the intestines occasionally containing all the requisites necessary to produce putrefaction.

They are considered endemical when particular countries are more subject than others to a visitation of certain diseases, arising from peculiar causes, generated more frequently and in greater proportion; the state of the atmosphere being vitiated more or less, according to the proportion in which the causes producing them originated; these arising from local situations.

Epidemics are diseases which, at certain times, are popular, and attack many people at the same time. These distempers appear, and generally prevail, then for a time disappear; they are ailments to which every country is more or less liable to be affected, according to circumstances. The modes
by

by which the fluids causing these diseases are taken into the constitution will be considered in another part of this work.

Permit me, before I enter upon the manner of preventing the dysentery, to make a short digression, in order to remark upon nosologies, as the systems now extant are very exceptionable in several points of view.

The best nosological arrangement, at present, is that formed by CULLEN; this elaborate and tedious work, though very imperfect in its classification, has its use; its defects will point out to a future nosologist how to avoid the improprieties which it possesses; yet the manner in which this laborious philosopher has described many of the diseases, will be sufficient to hand down his name to posterity. But this, like previous arrangements, is very exceptionable. As long as the nosologists shall form their arrangements upon any other basis than the true cause of diseases, so long will they be defective.

The only true method of forming a perfect and lasting classification of diseases, is to trace them from the causes which produce distempers; and all maladies arising from the same cause should be classed together, and under the same genus, and their variations should be marked as different species. Besides the method of the arrangement of CULLEN, some of his terms are also liable to objections, as being vague and unmeaning. His term fever is the most so of any other, upon this principle, that it conveys no proper idea of the disease. *Fever* is derived from the Latin word *fevere*, to burn, or be hot: this alone shews the impropriety of the term; for it is well known to physicians, that what is called fever frequently exists without any increased heat; but, on the contrary, it is lower than the temperature of the body in a state of health. And further, if heat be the criterion to judge of the presence of fever, every local affection of some internal part will come under this denomination; "in fact, the whole number of symptoms enumerated in fevers, are so many distinct diseases."

“eases.”* CULLEN also places synocha with the simple affections termed fever. I question very much, however, the propriety of this classification; a pure synocha, unaccompanied with a local affection, very rarely if ever occurs, and ought to have been ranked with those diseases. The term dysentery is liable to the same objection: it would, perhaps, be more proper to call it the remitting fever of the alimentary canal. With regard to the arrangement, it is still more exceptionable than the name; it ought to be arranged with the simple fevers, as it is produced by the same cause, and is only a different species of the same genus. The diarrhoea and cholera-morbus are also misplaced, as they frequently arise from the same cause with the dysentery: their proper place would be different species of the same genus; and their method and indications of cure are the same with those of the diseases before-mentioned; and, in short, all the diseases arising from pestilential fluids ought to be arranged under the same genus, and formed into species, according as they are found to vary in their affection; for the same general treatment will hold good in them all.

If I should proceed to point out all the imperfections of this nosologist, (which are less than any of his predecessors) I should far exceed the limits prescribed to a dissertation. My intention, in these remarks, is not to detract any thing from the merits of the author, but only to point out what seemed to me to be the best plan of constructing a nosology, which should be capable of standing the test of time, and which should be a compend of the practice of physic; by which means the young and inexperienced practitioner would not be misled from the proper method of treating diseases; for, by recollecting the treatment of one form of disease, the same ideas would apply to every species of that genus: he would there also find the exciting cause, and would proceed to remove that cause, not the symptoms; as this is the surest and the

* Preface to Zoonomia, vol. ii. p. 10

the only way we can remove diseases. It is too frequently the case, at present, that physicians prescribe remedies for symptoms; and until practitioners pay more attention to discover the true causes, there will always be some diseases which will baffle physicians in their cure. It is on this account that some of the diseases have been stiled the opprobrium medicinæ, because physicians are not acquainted with the exciting causes producing them.

SECT. VII. *The Method of Prevention.*

HAVING completed the consideration of the physiological, and entered upon the pathological parts of the subject, it yet remains incumbent on me to consider the method of prevention and cure. The prevention of diseases is as much the care of the physician as the cure of them, and requires a greater degree of penetration and discernment, as a perfect knowledge of the causes, and also the circumstances necessary to produce them, is requisite. The cure, in some cases, may be made from a mechanical knowledge of medicine. In order, however, to prevent this disease, the following indications ought to be observed.

1st. The patient should avoid all septic aliment, such as the whole class of animal substances, except their oils and fats, in that season of the year in which the disease is most prevalent, and substitute a vegetable diet. Lean and muscular animal substances, as has been shewn, contain a large proportion of the basis of pestilential fluids, which, combined with oxygene, have been proved to be the cause of dysentery; and, on the contrary, that vegetables contain it in a less proportion: hence, then, it follows, that vegetable diet is to be preferred to that of animal.—The atmosphere is impregnated with this deleterious fluid, which, being taken into the body by means of the stomach, lungs and absorbing vessels, will, if there

there be no addition from within, produce only a mild affection; but if, through septic aliment, there be an addition from within, the disease will be aggravated, and instead of a mild dysentery, a more violent affection will ensue: from which the necessity of prohibiting septic food must be evident.

2d. The next consideration which presents itself to our view, is the avoiding costiveness. This has been universally considered by HIPPOCRATES, GALEN, and their followers down to the present time, to be an important consideration in preventing diseases in general; and in no case will it be found more necessary than in the present. The fæces, by remaining stagnant in the alimentary canal, and undergoing putrefaction, will produce the pestilential fluid, or the cause of this distemper of the large intestines, as has been proved in a former part of this dissertation; and by this means, if there be no addition of septic (nitric) acid from the atmosphere, a sporadic dysentery will be produced. Costiveness also weakens the body, and predisposes it to the operation of contagion; by which means it lessens the power of the system to become habituated or seasoned to the influence of the stimulus of pestilence: it also indicates an interruption in the process of digestion.—It will appear evident, that this state of the bowels ought to be attended to, from this consideration, that the fæces being suffered to undergo putrefaction in the intestinal tube, the matter of contagion will be formed there: this being united with a pestilential state of the atmosphere, the patient will be more liable to be affected by it than those who receive no addition from within; and if the pestilential state of the atmosphere should be so considerable as to be sufficient to produce this disease, it certainly will be aggravated by such addition.

3d, and lastly. The patient should avoid a pestilential air, which, according to the state of impregnation of the atmosphere, will be found more or less liable to affect the alimentary canal; nay, such situations should be avoided as the only certainty of escaping the disease. Although some constitutions

tions are capable of remaining in tainted atmospheres without being taken sick, owing to the system becoming habituated to the action of this stimulus; yet this is no certain criterion to form a judgment, whether or no a person will escape the operation of this pestilential fluid: this, however, is certain, and for the reasons before stated, that persons abstaining from animal diet will be more likely to escape infection under similar circumstances, than those who make a free use of it. For the same reason it will appear, that of two persons, under a similarity of circumstances and situation, the one using animal food, the other vegetable; the former will be more severely attacked by this disease than the latter. If proper attention be paid to these circumstances, they will generally prove sufficient to prevent any affection of the large intestines: it will, however, frequently happen, from the particular circumstances of some inhabitants, that these observations cannot be complied with, and they will be attacked with this malady: they will therefore become the objects of cure.

SECT. VIII. *The Method of Cure.*

IN order to make a cure, the physician must administer such remedies as will prevent the disease, or exciting cause, from wearing out the excitability of the part affected. When I speak of curing the disease, I would not wish to be understood as meaning to prescribe a specific; for we have no such medicine; and it is a doubt whether any such remedy has ever cut short a disease: I therefore mean such remedies as will lessen the operation of the cause, in order that the body may not sink under its deleterious operation; and in so lessening this fluid, the body will, with greater certainty, become habituated to this particular action of the exciting causes; particularly as the disease will run its full time before a person can recover from any attack. It is upon this principle that all diseases are

said to be cured, though the recovery has been ascribed to certain remedies, and it is upon this principle that we can reconcile and explain the success with which some opposite remedies have been in vogue, in curing diseases. Physicians may be equally successful in certain mild diseases, although they make use of the most opposite remedies. The constitution of man possesses the power of becoming habituated to the action of certain substances which are deadly in their operation, beyond conception. We find that the most inveterate poisons may be taken with impunity, and little or no inconvenience be experienced from them, provided a certain quantity be taken at first, and gradually increased. If a person, who is not accustomed to poisonous matter, takes a dose less than one which an habituated person may take, immediate death will be the consequence. This power to take large quantities of poisons is sufficiently verified in the single instance of persons who are capable of taking a wine-glass full of laudanum without experiencing any other effect than a species of intoxication; while, on the contrary, a person unaccustomed to its stimulus would die almost instantly. Who is that presumptuous physician that would pretend to cure the small-pox? I believe none will be found who has hardiness enough to attempt any such thing. The only circumstance to which the physician has to attend, is to prevent the variolous poison from producing indirect debility: the constitution will become gradually habituated; and in this manner the patient gets well. The same thing takes place in the measles; and I have not the least doubt, that every disease has a certain period to which it will run in spite of all the healing art can do, and at which time the body will become habituated to the stimulus producing the disease. There are, however, some constitutions which require a longer time to become familiarized than others; and when they are incapable of becoming habituated, death must ensue; as it must also

when

when the degree of the exciting cause is very considerable, and receiving continual additions.*

The indications of cure are three: 1st. To remove septic and feculent matter from the alimentary canal. 2d. To correct the vitiated state of the atmosphere, or to remove from it. 3d. To allay the inflammation, and the other injuries which the alimentary canal may have sustained by the original cause of the disease, and the remedies made use of to effect a cure.

1st. Great care should be had to evacuate the contents of the intestines freely, in order to remove any septic or feculent matter which may be found there. The reason for this precaution is obvious, as these substances, if left in the alimentary canal, would act as a fountain to foster or generate the original or exciting cause, and add to the violence of the disease. The remedies which I shall recommend for this purpose are, the carbonate of pot-ash (salt of wormwood), acetate of pot-ash (regenerated tartar), sulphate of pot-ash (vitriolated tartar), tartrate of pot-ash (soluble tartar), tartrate of soda (Rochelle salt). These salts are decomposed by the septic (nitric) acid, which coming in contact with them, the alkaline bases will part with the acids with which they are combined, and unite with the septic according to the laws of attraction, and form with them septites. By this means the cause of the disease will be removed, and the patient restored to his former state of health. The muriate of soda (common sea salt), with the vegetable acids, is also highly recommended in this disease. WRIGHT† observes, that marine salt dissolved in any of the vegetable acids, operated as a charm in dysenteries, in the Island of Jamaica, when all the other remedies which have been celebrated in curing this disease had failed.

This

* Vide Appendix B.

† Medical Commentaries, Philadelphia edition, vol. vi. p. 121.

This is corroborated by the experience of others. This salt, like all the others, owes its good effects to the alkali with which the marine acid is combined, the septic (nitric) acid being stronger and having a more powerful attraction for soda than the muriatic: the soda quits its combination with its former acid, and combines with the septic (nitric), forming a septite of soda.

The vegetable fixed alkali (carbonate of pot-ash) will be found to be a very efficacious remedy in this disease, as appears from its effects in the two cases annexed to this paper, where it has had the desired effect, while all the other remedies generally employed had failed. The dose which may be given with safety is four grains dissolved in half an ounce of water, and repeated every two or three hours, until natural stools are evacuated. If jalap or rhubarb be combined with vegetable fixed alkali (carbonate of pot-ash) its operation will be greatly assisted; for, while the pot-ash attracts the septic (nitric) acid, and destroys its deleterious quality, the jalap or rhubarb will tend to remove the matter contained in the alimentary canal. The oleum ricini and the cerated glass of antimony have also been found to be of service in removing the contents of the intestines. After having evacuated the intestines, we are next to endeavour to relieve our patient of the tenesmus: this will be answered by making use of the starch enema with the tincture of opium; a mucilage made of any of the gums, as the gum arabic, a decoction of marsh-mallows, with laudanum, or an oleaginous mixture with anodynes. While the tincture of opium tends to take off that extreme irritability of the intestines, the starch forms a sheath for them, which defends them against their acrimonious contents, and in this manner supplies the place of the mucus, which is destroyed by the septic acid.

While we are turning our attention to the alimentary canal, we should not neglect to cleanse the body externally,
in

in order to remove all septic matter from its surface, which, if neglected, would, in a great measure, retard the recovery of the patient. For this purpose I would recommend the cold bath, which, while it cleanses the body, will, at the same time, subduct the stimulus of heat, and make the patient more comfortable, and also produce a diaphoresis.

2d. After having cleared the alimentary canal of the pestilential matter existing there, the next circumstance which requires the attention of the physician is the state of the atmosphere surrounding the patient. The vitiated state of it is to be corrected; or, if we should not succeed, we are to remove the patient. The chamber of the sick ought to be perfectly ventilated, and frequently changed; and care should be taken, immediately after the removal of the sick, to clean the floors with alkaline ley, and white-wash the walls with lime. By this means the pestilential matter will unite with the lime and alkali, and form septites, and thus be taken out of circulation.

Sprinkling cloths with vinegar would supply a grateful odour to the sick. The food of the patient must not be cooked in an impure atmosphere, for pestilential fluids have a great tendency to mix with water; neither ought the drinks of the patient to be suffered to remain in vitiated air; for, through the neglect of these precautions, we may unexpectedly find the disease increased, without being able to account for it. The frequent changing of the bed-cloths will also greatly contribute to the recovery of the patient, as it is a notorious fact, that they are capable of imbibing large quantities of the matter of contagion, especially woollens, cottons and feather beds; and further, they are very apt to communicate it to persons who are in health: we cannot, therefore, be too careful and attentive to these circumstances. The linen of the sick ought also to be very frequently changed, as much of the success of our practice depends upon a due attention to cleanliness.

I cannot, in this place, help noticing a practice which commonly

monly proves too fatal to the sick, but which has been strenuously recommended by certain practitioners, in order to purify the atmosphere—a method which must appear to every intelligent and candid observer as highly reprehensible; and instead of purifying the atmosphere, must make it less pure than before—a practice which must be considered to be injudicious and improper in the extreme, and can only be the result of ignorance and prejudice. The practice I allude to is the burning of certain combustible substances, as tar and sulphur; nay, any attempt to purify the air by combustible materials ought to be avoided, as they act powerfully in vitiating the atmosphere; and upon this principle; during combustion, oxygene (vital air), so necessary to support flame, is absorbed, by which means that vital fluid which already exists in too small a proportion in the atmosphere, is destroyed, and thus the air necessary for animal existence will be intirely expelled, or at least so much diminished as to endanger the life of the patient.

If, however, we should not succeed in purifying the atmosphere, we should remove the sick out of it into that which is uncontaminated by this pestilential poison. This precaution we ought never to omit, whenever the situation is such as to render it practicable. This will greatly accelerate the recovery of the sick, as every addition from without must greatly retard the cure, and most generally will wear out the constitution, and cause the death of the patient; for, during the continuance of the patient in such an atmosphere, the power of becoming habituated to the disease may not always be sufficient to counteract the continual accumulation of the pestilential stimulus.

3d. In the last place, we are to turn our attention to allay the inflammation, and other injuries which the alimentary canal may have sustained, by the original cause of the disease and the remedies made use of in order to effect a cure. For this purpose, bleeding will be necessary, not only to allay the inflammation,

inflammation, but also to prevent the matter of infection from wearing out the excitability of the heart, and producing indirect debility, and its frequent consequence, death. That there is infectious matter in the sanguiferous system, is certain from the fever which attends this disease. While we administer cathartics to the alimentary canal, we should not neglect to purge the blood-vessels, and subduct the stimulus or infectious matter from the blood; the bleedings should be small and frequent; but this, in a great measure, must depend upon the judgment of the practitioner, as circumstances should require: we should not be deterred from taking a sufficient quantity on the approach of syncope, as no bad consequence will arise from this circumstance; nor should we be prevented from repeating it, from the disease or fever not yielding to the second or third bleeding, nor, in the first instance, from the smallness or weakness of the pulse, as it will rise after or during bleeding. In this manner the blood-vessels will be emptied or cleared of the matter of infection; when the patient should be directed to take nourishing soups. In order to shew more clearly how bleeding will lessen the quantity of pestilence contained in the blood-vessels, I shall explain in numericals. Suppose, for instance, the blood contains pestilential matter equal to 100, and by bleeding you draw off a portion equal to 20, it is evident, that there will remain infectious matter equal to 80: if, therefore, the operation be repeated two or three times, you will reduce it to less than half its original quantity. This is not the only advantage derived from bleeding; it is a powerful sudorific, which is also of consequence to be attended to, as the remedies commonly administered for this purpose are too stimulant: the most of them contain opium, and therefore illy accord with the inflammation in the intestines. The injuries which the alimentary canal has sustained from the original cause of the disease and the remedies, ought also to be attended to. It will perhaps be asked, what injury the remedies do to the intestinal canal?

canal? or how it can be possible that remedies can do that injury, and yet the patient get well? The medicines made use of for this purpose must certainly have some effect upon the guts, or otherwise they would not be capable of producing any change whatever, but be inert, which is not the fact. They must operate from some stimulant quality inherent in them; and every thing that stimulates must leave an effect after the operation of such stimulus; but still the good effect which they produce greatly overbalances the situation in which they leave those parts, which is much less than the original cause, and from which the patient will sooner and very readily be relieved, by the efforts of nature alone. To shew this, I shall suppose the operation of the pestilential fluid to be as 100, and the effect of the remedy as 10: now, if by giving the remedy we remove the original cause, which is as 100, there will remain a diseased state of 10 in the alimentary canal; consequently the lesser evil will be preferred to the greater. To repair these injuries, mild tonics, and a rich and nourishing diet, together with pure air and gentle exercise, will be sufficient.

The diet for the use of the patient should be rich soups, milk and vegetables: the lean part of animals ought to be prohibited during the whole period of the disease, and even when the health of the person is restored it ought to be used very sparingly, as it would be liable, from the powers of digestion being weakened, to bring on a relapse: it could not be completely digested, and putrefaction would take place, and regenerate the cause of sickness, more especially if the disease occurred in that season when the atmosphere is more or less charged with pestilential vapours.

The tonics ought to be mild, as the excitability must be reduced to the healthy standard, otherwise we should endanger the patient by producing another disease; for the excess of stimulus destroying the excitability, or reducing it beneath the healthy point, will occasion a disease as dangerous as the original.

ginal. An infusion of the chamomile flowers has been much esteemed: if to this infusion a small proportion of the carbonate of pot-ash (the salt of wormwood) be added, it will be greatly aided in its operation; for this reason the debilitated state of the stomach and intestines, from the operation of the septic compounds, will incapacitate them from performing their functions completely; consequently a small portion of the septic acid will perhaps be formed, and endanger a relapse. Now, while the tonic quality of the infusion tends to restore the system to its healthy point, the alkali will assist it, by destroying the septic compounds which may be formed, and thus tend to prevent a second attack, and insure a more speedy recovery. The colombo, the cinchona, and all the other mild tonics may be used; but the particulars of them must be left to the prescriber and the particular circumstances of the patient.

C A S E S.

I am favoured by Dr. BAKER with the following Case.

“ I WAS requested to visit Mrs. F—CH on Sunday, Feb.
 “ 5, 1797; I found her of a slender habit, light hair, large
 “ eyes, round face, about twenty-two years of age, in the se-
 “ venth month of her pregnancy. She complained of pain in
 “ the abdomen, tenesmus, frequent mucus stools streaked
 “ with blood, pain in the head, nausea, and small quick pulse.
 “ From the above symptoms it appeared to be a case of true
 “ dysentery, and I ordered the following medicines: Ol. ri-
 “ cini half an ounce, statim sumend. et omni semihora repe-
 “ tend. si causa fuerit.—Monday morning nausea had sub-
 “ sided; all the other symptoms aggravated; restless all night.
 “ —R. infus. senæ tartaris eight ounces, coch. iij. 2d. quaq.
 “ hora sumend.—Monday evening, six o’clock, debility
 “ rather increased: the tenesmus still continued.—R. gelat.
 L amyli

“ amyli six ounces, tinct. opii gut. 50 misce pro enem. omni
 “ bihora utend.—R. kali ppt. 5 grains (pot-ash) aq. puræ
 “ one ounce, misce pro haust. omni hora sumend.—Tues-
 “ day morning, the patient had rested well in the night, ex-
 “ cepting the fatigue which taking the medicine occasioned:
 “ pulse not so frequent: tenesmus relieved: a quantity of scy-
 “ balli were discharged.—Perget in usu solut. kali (pot-ash).
 “ —This patient recovered by using the following decoction.
 “ —R. kali ppt. one drachm, (pot-ash) flor. cham. half an
 “ ounce, rad. serp. virg. one drachm, aq. puræ 16 ounces,
 “ coque and cola cap. one ounce, quart. in die.”

The following Case occurred in the Practice of Mr.
 J. B. JONES.

“ Mrs. S—TH, aged 45 years, of a tall thin habit, who had
 “ been several years afflicted with hemeplegia, applied to
 “ Mr. BAKER, who desired my assistance in consultation.
 “ On the 4th of Feb. at 11 o’clock, I paid my first visit, and
 “ observed the following symptoms:—Considerable pain in
 “ the umbilical region—tenesmus, attended with a discharge
 “ of bloody mucus, pain in the head, which was augmented
 “ on the admission of light—coldness of the extremities—dry
 “ skin—tongue of a brown colour—pulse 120, very small
 “ and weak.

“ This appearing to be a well marked case of dysentery,
 “ and believing that disease to arise from the presence of the
 “ septic acid (the acid of contagion) in the intestinal canal, we
 “ came to the resolution of trying the effects of alkaline re-
 “ medies, and to quiet the tenesmus by anodyne glysters.—
 “ R. gelat amyli unc. quat. tinct. opii gtt. 40. M. ft. enema
 “ stat. injiciend. et pro re natâ repetend. In the next place,
 “ attending to the pulse, and with a view to raise them.—R.
 “ ammon gra. tres, aq. menth. pip. unc. unam, m. ft. haust.
 “ 3tia.

“ 3tia. quaq. hora sumend.—8 in the evening; pulse more
 “ full, and consequently less frequent; skin somewhat moist;
 “ tenesmus relieved considerably. Contin. in usu medicam.

“ Feb. 5, 11 o'clock; rested well all night; pulse more
 “ quick than last evening; skin dry—ordered the feet to be
 “ bathed in warm water.—R. aq. ammon. acetat. unc. unam,
 “ menth. pip. unc. sep. m. et cap. coch. iij. 3tia. quaq. hora.
 “ —8 o'clock in the evening; in every respect worse.—Rep.
 “ enema, anod. omni bihora. Mittet ol. ricini unc. tres, cap.
 “ coch. un. omni bihora donec alv. respond.

“ 6th. Ten in the morning; restless in the night; frequent
 “ vomiting; pulse low, quick and small. The oil appearing
 “ to be the cause of the most distressing of the above symptoms
 “ (vomiting), it was discontinued.—R. tinct. opii gtt. 30, aq.
 “ menth. pip. unc. unam, m. ft. haust. statim sumend.—R.
 “ tartrit. potasse dra. un. 2d. quaq. hora sumend.—10 o'clock
 “ in the evening—after the anodyne had quieted the patient's
 “ stomach, the tartrate of pot-ash was administered, three of
 “ which powders procured an evacuation of the intestines,
 “ in which a small quantity of scybala were discharged; the
 “ pulse was remarkably low and scarcely perceptible: she
 “ had frequent faintings, and could be persuaded to take no
 “ more medicines until the 10th, when a diarrhoea came on,
 “ together with profuse uterine hæmorrhage; cold extre-
 “ mities; intermittent pulse. Cold applied to the pubis and
 “ loins checked the hæmorrhage. The anodyne injection
 “ was frequently repeated. And the patient recovered by
 “ using the following decoction:—R. flor. cham. unc. dimid.
 “ potasse drachm unam, aq. puræ unc. sex decim, coque and
 “ cola cap. coch. iij. 3tia. quaq. hora.”

In a Letter from W. SALTONSTALL, M. D. dated at New-London, March 5, 1797, to the Author, are the following Remarks.

“ ON Saturday I was consulted by a labourer in the case
 “ of his wife, who, he said, had been for some days afflicted
 “ with griping pains, and discharges, by stool, of blood, al-
 “ ternating with green slimy matter:—On Sunday morning
 “ I visited her at her house, about two miles from town, and
 “ found her affected with *dysentery*, which had troubled her
 “ for more than a week past; during which time her strength
 “ had been gradually decreasing, so that she was now unable
 “ to walk across the room: pulse quick, tongue little furred,
 “ skin dry, and complains of loss of sleep. I directed an
 “ ounce of the ol. ricini to be taken immediately, and a large
 “ anodyne draught to be taken h. f. The next morning found
 “ the cathartic medicine had operated freely, and she was
 “ much relieved of her pains. I began now to exhibit the
 “ soda in powder, in doses of a drachm each, thrice a day:
 “ these were continued for two days only, when the stools
 “ became changed from a bloody and greenish, to that of a
 “ yellow appearance, occurring in frequency much as in the
 “ usual state of health. The other symptoms disappeared,
 “ and the patient was so well on the following day as to su-
 “ percede the necessity of any further attendance.”

CHAP. III. *The Theory of Pestilential Fluid.*

THE theory of contagion is simply this, that septon (nitro-
 trogene), in combination with oxygene (the principle of aci-
 dity), forms a compound which, when applied to the bodies
 of animals, will produce the varieties of fevers and other in-
 fectious

fectious diseases, according to the parts to which it is applied; and these will be inveterate or mild, according to the degree of combination of these substances. In the first degree, it will form the gaseous oxyd of septon; in the second, the septic gas; in the third, the septous acid; in the fourth, the septic acid; and in the fifth degree, the oxygenated septic acid.

The ingredients of this matter of contagion constitute the chief part of our atmosphere; they exist in the following proportions: septous gas, 72 parts of an hundred, and 28 parts of oxygene. Hydrogene gas and carbonic acid gas are sometimes found existing in the atmosphere; but they are only considered accidental, and not necessary. The particles of these fluids float about, in ordinary circumstances, through each other, by means of the wind, which are necessary to keep them mixed, in like manner as oil is kept mixed in water by a continual agitation; but no sooner is the oil and water suffered to be at rest, than they separate; and the same would take place with the component parts of the atmosphere, were they not kept in continual motion by the winds, as they differ in many degrees of specific gravity. But these have, under certain circumstances, attractive powers strong enough to make them frequently combine. The principle cause which prevents their combination, after they have acquired an aerial form, is the greater affinity they have for caloric or the matter of heat (which gives them the properties of an elastic fluid) than for each other. Whenever, therefore, septon (nitrogene or basis of azotic air) and oxygene (basis of vital air) can come together, without assuming the aerial form, they will combine together according to the laws of chemical affinities, and constitute, in this form, pestilential fluids, varying in proportion to the degree of oxygenation, and possessing qualities very different from either of their elementary or component parts.

This combination is produced by the particles of the one becoming intimately and chemically blended with those of the other:

other: this will take place in every circumstance where they can come in contact with each other before their union with caloric, or the matter of heat. This chemical union is most generally the product of the putrefaction of the greater part of animal substances, except their fat; and of vegetables which contain septon, such as wheat, coffee, &c. Rain-water is found to contain a considerable proportion of the septic acid, as also the wells and reservoirs of hot climates. It is also found to exist in the plaistering and walls of old houses, especially if the inhabitants have lived in an unclean manner, and the house stood in the neighbourhood of foul and corrupted vapours. Jails are also found to have the lime saturated with septic acid. This is verified by the following description of the late keeper of the state-prison of Olmuts, where LA FAYETTE is confined. “ Besides many other inconveniencies, “ the situation of the dungeon is rendered more unwholesome “ by the vicinity of the barracks on one side, and the common “ necessary-house on the other, the damp of which is so “ great as to cause the walls to be covered with salt-petre.* “ The *stagnated water* of the Morawa, close to them, not “ only breed innumerable swarms of insects and thick va- “ pours, but that branch which passes along the walls, under “ their windows, being, by its depth, favourable to carry off “ the filth, &c. of the city, has become its common sewer: “ to which circumstances is attributed the reputed insalubrity “ of the town. Add to this, that the nearest buildings are, “ on one side, the military, and, on the other, the city hospi- “ tals.”†

Before I leave the subject of pestilential fluids, I shall make a few remarks upon the similarity of these sentiments, with several passages in DARWIN's *Zoonomia*. In treating of the *febris a pure clauso*,‡ he has the following sentence. “ In “ this

* The *sal muralis* of Walker, *terrene nitre* of Cronstedt, and *nitre calcaire* of Morveau.

† Vide account published in M'Lean and Lang's paper, Feb. 15, 1797.

‡ *Zoonomia*, vol. ii. Class II. 1. 6.

“ this fever, the matter not having been exposed to the air,
 “ has not acquired oxygenation; in which a new acid, or
 “ some other noxious property, is produced, which acts *like*
 “ *contagion* on the constitution, inducing fever-fits, called
 “ hectic fever, which terminate in sweats or diarrhoea; where-
 “ as, as the matter in the closed abscess is either not absorbed,
 “ or does not so affect the circulation as to produce diurnal
 “ or hectic fever-fits; but the stimulus of the abscess excites
 “ so much sensation as to induce pestilential pyrexia, or inflam-
 “ matory fever, without such marked remissions.”—“ But in
 “ the pulmonary* ulcers, which cannot protect themselves
 “ from the air by forming a scab, the uncombined oxygene
 “ of the atmosphere unites with the purulent matter, convert-
 “ ing it to a *contagious ichor*, which, by *infection*, not by
 “ *erosion*, enlarges the ulcers, as in the itch and tinea, &c.”
 —“ Another† proof of the stimulant quality of oxygene,
 “ appears from the increased acrimony which the matter of a
 “ common abscess possesses, after it has been exposed to the
 “ air of the atmosphere, but not before; and probably all
 “ other contagious matters owe *their fever-producing proper-*
 “ *ty to having been converted into acids by their union with*
 “ *oxygene.*”—“ The matter‡ deposited in large abscesses does
 “ not occasion hectic fever, till it has become oxygenated by
 “ being exposed to the open air, or to the air through a moist
 “ membrane: the same seems to happen to other kinds of
 “ matter, which produce fever, or which occasion spreading
 “ ulcers, and are thence termed contagious.”

His febris *a pure aerato*§ is ascribed to the union of the
 oxygenous portion of the atmosphere with the effused pus,
 converting it to a *weaker kind of contagious matter*. Doubt-
 less, in the cases alluded to by DARWIN, the *oxygene* com-
 bines

* Vol. ii. p. 288.

† P. 689.

‡ P. 729.

§ Vol. ii. p. 285.

bines with *septon* (nitrogene), and the acid formed is the *septic (nitric) acid*. This is the product which MITCHILL supposes to be occasionally formed from the materials of some articles of diet, in the alimentary canal, and to cause certain nauseas, vomitings, gastrites, diarrhœas, choleras, dysenteries, &c. and absorbed from thence by the lacteals, or from the surrounding air, which he considers as poisoned by it, by exhalations from putrid substances in pestilential seasons, by the lymphatics of the skin and lungs, and excites various commotions in the heart and sanguiferous system, assuming the form of continued, remitting and intermitting fevers. What is particularly to be noticed is, that it does not appear that this coincidence of opinion between our PROFESSOR OF CHEMISTRY and the PHILOSOPHER OF DERBY, is the result of any communication of ideas between them on the subject; Dr. DARWIN having indeed published his book before Dr. MITCHILL wrote, but Dr. MITCHILL having gone deeply into the subject, and delivered his doctrine of pestilential fluids in his lectures, the winter of 1795-6, before the volume, whence the above extracts are taken, had reached AMERICA.

IT is with great satisfaction I observe the Editors of the Monthly Review * have taken notice of the dissertation of SALTONSTALL, on the chemical and medical history of septon, and treated it with candour and politeness. They forbear giving any decision on the new doctrine of contagion, until they have received farther information on the subject. As this inaugural dissertation is intended as a further investigation of the subject, and a more particular application of it to another form of disease, I have endeavoured, as far as I am able, to collect, from the wide field of scattered facts, such as

were

* Appendix, September, 1796.

were applicable to the subject, in order to shew how nearly the theory accorded with the phenomena of nature. How far I have succeeded in my attempt, I must leave to the candid and indulgent reader to determine. If this incorrect performance (as all those must be which undertake to explore new regions of speculation, that can only be thoroughly examined by the united and successive enterprize of all who engage in them) should fall into the hands of the Gentlemen Reviewers, I hope that spirit of liberality and forbearance which they have, upon similar occasions, evinced, will be extended to me, as my object in these pages has been to discover truth. In contributing my mite to the mass of information, I hope my labours may not be deemed entirely useless, and that my offering, however small, may be as favourably accepted as it was well intended.

APPENDIX A.

Effects of Pestilential Fluids (Combination of Septon with Oxygene) upon the Sanguiferous System of Animals, particularly the Human Species.—In a Letter from Mr. MITCHILL to JONATHAN N. HAVENS, Esq; Representative from the State of New-York in the Congress of the United States.

YOU write me, in your letter from Shelter Island, of the 20th of July, 1796, “that you have been reading SALTON-STALL’s dissertation on pestilential fluids with attention, and “that it has raised your curiosity upon that subject.” To gratify this further, you request me to send you the publication I made about a year ago on contagion, as you have not yet read that performance. It is out of print, and I have for sometime not known where to get a single copy. As it may, however, one day fall into your hands, I shall, in my present answer to your late favour, consider the subject in a manner different from any thing contained in that tract.

If I have not deceived myself, there are facts enough stated there and elsewhere, (my letter to MILLER,) to shew that septous and septic vapours (combination of septon, or azote, with oxygene) issuing from organized substances, in certain states of putrescent decay, in the open air, rise and contaminate the atmosphere near the earth, and in the habitations of men; and unless I am greatly mistaken, there is a sufficiency of facts to persuade us, that similar products are formed at times in the human stomach; when, on a suspension of the concoctive process, a load of *beef*, half-tainted and half-raw when eaten, corrupts in a British or American stomach, and causes gastritis and black-vomiting. I mention *beef* particularly,

larly, because, in RAMMAZZINI's account of the contagious epidemic which infected the neat cattle throughout almost the whole of the Venetian dominions in 1711, (Opera. Med. & Ph. p. 460.) we are informed, that, on some former occasion, there took place disputes between the butchers and inhabitants, both at Venice and Padua, about the quality of the beef brought to market. It seems, many of the people who ate the beef became sick, and died of dysentery. The blame of this was thrown upon the butchers, who were charged of buying up sickly cattle in Hungary, and selling their distempered flesh to the people. This matter being referred to the physicians, they gave an opinion in favour of the butchers. Whence it would seem, that complaints of the unhealthy quality of this sort of animal food are by no means new and unprecedented.

Pestilential fluids, thus exhaling from the surface of the earth, may completely surround the human body, and be applied to the whole cuticular and pulmonary surface, as well as to the entire mouth and nostrils: and the like productions, generated in the alimentary canal from corrupted food, may be spread all along the intestinal tube, so that the internal surface from the gullet to the anus, may be at times partially, or entirely disordered by them.

If such noxious substances are applied, both externally and internally, to so large a surface, it might be expected they would have something more than a local operation, and extend their influence beyond the mere part which they touched. These exhalations acting *externally* in their strong state, may instantly kill, by stopping respiration; may cause, by their caustic quality, ulcers to form, blisters to rise, and mortifications to spread along the skin; and they may inflame the nose, throat and eyes, and cause pimples and spots of various shapes and hues to appear; or, by *internal* agency, similar fluids may excite an erythematic or erysipelatous inflammation in the stomach and intestines, inducing gastritis, diarrhoea, and
dysentery,

dysentery, with destruction of the lining of the guts, effusion of blood from the corroded vessels, and ulcerations, gangrene, and sphacelus, from their caustic sharpness. But these are not all the effects which such deleterious fluids are capable of working on the living body. Can it possibly happen, that pestilential fluids shall come in contact with the lungs, skin and intestines, whose surfaces are thickly beset with absorbent vessels, and that their noxious matters shall remain around the orifices of those inhaling tubes for a very long time, and yet no atom or particle of them be taken in? Will not a portion of them be sucked up by the lacteals from the intestines, and by the lymphatics, from the other exposed surfaces of the body, and through their channels be conveyed into the mass of blood? Will not the blood, on receiving these foreign materials, assume new qualities, and, as it travels the round of circulation, carry with it mischief and venom to the brain and nervous system? Let us examine these questions.

First, let the appearances be observed which blood exhibits in the vessels of those who are dead of pestilential distempers. The dissections of this class, mentioned by LIEUTAUD, (which I shall take, because the book lies before me on the table) are all declared to be attended with changes of the blood of a remarkable nature—blood taken away by venesection being in a short time liable to corrupt in *putrid* fevers (I PRECIS de la Medicine, p. 45.); in the hepatic veins of *ardent* fevers being black, and having a resemblance to pitch, (p. 56.); in *malignant* fevers sometimes appearing to be in a state of dissolution, and at others very thick, and formed into polypus concretions, (p. 70.); the heart and vessels in the *plague* very much enlarged, and filled with black and grumous blood. (p. 86.) In those who die in the cold fit of *intermittent* fevers, the blood is black and thick, distending the lungs, heart, and large vessels, (p. 96.) the vena portæ being prodigiously distended.

Secondly, it will be next proper to see what are the effects of

of septous and septic airs, when injected, artificially, directly into the blood-vessels of living animals.

LUZURIAGA, one of the king of Spain's philosophical pensioners, injected septous gas (azotic air) into the jugular vein of a dog. The animal almost instantly expired; and on opening the thorax, the blood in both ventricles and auricles of the heart was found thick and dark coloured, though less so in the left than the right; which latter was full of polypi: the vis insita of the muscles, and the irritability of the heart, were destroyed.

He also injected septic gas (nitrous air) into the jugular vein of another dog: on examination after death, the blood in the auricles and ventricles was of a darkish purple, or blackish hue; polypi were found in the right cavities; and blood, a shade or two lighter, in the left. The irritability of the heart was very much diminished, and the lungs considerably damaged by the air injected. (Tentamen Medicum, &c. Exp. 4 and 6).

Thirdly, there will likewise be a propriety in examining what changes septic gas makes upon blood drawn out of the vessels. *Arterious* blood (Ibidem. Exp. 12.) running into a vessel filled with septic gas, quickly coagulated; a greenish coat formed upon the surface; the crassamentum towards the bottom was dark coloured and less green; the quantity of serum was small and greenish. *Venous* blood, treated in like manner, exhibited a large quantity of dark coloured serum, without any greenness.

From the comparison of the blood in these dissections with the blood treated with the septous and septic gases, it is evident there is in both cases *a loss of floridity, an acquisition of a dark or black hue and spissitude, tending to the formation of grumes or polypi*; and, as far as inquiry has been made, I think we are warranted in concluding, that such changes in the blood take place more or less in *all distempers springing from pestilential miasmata, or contagious vapours*. A question,

tion, however, arises, whether the altered condition of blood in febrile disorders, is owing to the same cause which brought on a similar state of it in LUZURIAGA's experiments? or rather, whether septic (nitrous) compounds do not sometimes insinuate themselves into the blood vessels, and bring on the above recited state of the vital fluids? I am inclined to think this is the case. And though I am far from believing that septous and septic compounds, in their proper form of gases, can, by any natural process, get into the circulating system of living animals, yet it appears to me highly probable, that the septous and septic acids may be occasionally inhaled, in conjunction with other fluids, both by the lacteals and lymphatics, and thus enter into the sanguiferous tubes.

I shall doubtless be considered a favourer of the humoral pathology, from my dwelling upon the morbid conditions of the fluids and humors. I own that I am. A fashion has too long prevailed of referring every thing immediately to the solids; and this has been carried so far, that febrile diseases in particular have been deemed original affections of the nervous system. This doctrine of the nerves and solids has been carried a great deal too far by CULLEN, BROWN, MILMAN, and their followers, who, in their zeal for supporting *the vital excitement of the moving fibre*, have overlooked half the facts which appertain to the subject. This is so much the case, that there is a certain symptom occurring sometimes in the course of malignant diseases, and not noticed by either of those writers, the true interpretation whereof affords a guiding light through the devious and obscure region I have undertaken to explore.

1. Among the tokens of putrescent fever, as it occurs in the Island of Jamaica, especially when putrescent tendency is communicated from the primæ viæ to the rest of the body, there frequently comes on, towards the end of the distemper, an uncommonly fine and delicate bloom of the complexion, (JACKSON's Treatise, p. 101.) while the edges of the tongue
are

are clear and of a beautiful red in their colour, and the lips smooth and of a cherry-like appearance: when this beautiful blooming colour prevails, which is not natural to the patient, there is always reason to suspect danger. (p. 113.) It is presumable, that, in such cases, a highly oxygenated septic acid is formed in the alimentary canal, which is absorbed by the lacteals with the chyle, and carried into the blood-vessels, where, instead of attracting oxygene from the vital fluid, as septic gas does, it will give out a portion of its own oxygene to the blood, and impart to it a remarkable and unusual degree of redness. This property, which it possesses in common with vegetable and other acids, may thus heighten the colour of the blood, which, at the same time, from its tendency to lessen the living energy of the heart, by excessive stimulation, may be very operative in undermining the animal fabric, which it thus destroys, while it beautifies. We have seen, in the experiments related, how *nitrous* (septic) *gas* attracted oxygene from the blood. The same thing takes place when it meets with *vital air*. The two airs instantly combine, and a quantity of heat is evolved. The product of their union is *nitrous acid*, as DE LA METHERIE himself allows. (Essai Analytique sur l'Air, &c. p. 376.) This author, who is no friend to the new Nomenclature, admits, however, with THOUVENEL, that *nitrous acid* in the salt-petre works, is produced by the concurrence of pure air with *putrid* vapours. What then is putrid vapour but nitrous gas? Putrefaction *sometimes* goes on among the inanimate animal contents of the alimentary canal. Putrid vapour then must be formed. If this is nitrous (septic) gas, it will attract oxygene from the neighbouring substances, and be instantly converted to nitrous or nitric acid; and if this meets with no neutralizer in the bile or alkaline matter in the primæ viæ, it may inflame the stomach and intestines, be absorbed, oxygenate the blood, &c. &c. I think further, some pestilential matter vitiates the blood.

2dly. Because children born of mothers sick with the plague have been known to bring with them from the womb evident marks of pestilential infection. (RUSSEL, p. 95.) The foetus can scarcely be supposed to have bred the distemper within itself; the matter of mischief was therefore most probably received from the placental vessels of the mother; although there is no direct communication of maternal and foetal tubes, still the connexion may be imagined intimate enough to allow somewhat of the taint of the mother's blood, to pass through to the child. Or, if this explanation is deemed unsatisfactory, there is only one other possible mode of explanation, and that is through the medium of the liquor amnii, which must, in that case, have become contaminated with the pestilential venom passing unchanged through the secretory organs. In either case the point I am looking at is clear, viz. that the blood of the mother has something noxious in it.

3d. Because, whether the maternal blood be enough vitiated to infect the foetus or not, yet, women, in whatever stage of pregnancy, when distempered with plague, seldom escape abortion, and many of them perish, even when the loss of blood from miscarriage is not considerable. (RUSSEL, p. 95.) As the lungs of the mother have to provide oxygenated blood for the constitution of her yet unbreathing child, as well as for her own, it is easy to conceive wherefore the dark coloured, under oxygenated, pestiferous blood of the former, should be unable to restore the vital stimulus in due quantity to the effete and exhausted blood of the latter: for lack of this needful and exciting ingredient, the umbilical vein carries back to the young animal a mass of blood quite sluggish and inactive. The immature foetus of course dies and drops from the uterus, like unripe vegetable fruit from its branch.

4th. Because obstructions and swellings of the *inguinal* and *axillary glands* often accompany a pestilential condition of the air. The venom is, in all probability, imbibed by the absorbents, and carried with their other contents into the mass of blood.

blood. Buboes and glandular tumours thus occur only in comparatively a few cases, when the pestilential matter sticks by the way, and cannot find its passage freely along the opening into the left subclavian vein. I cannot help thinking the tumours of these glands, in pestilential cases, are as fair evidence of the poison absorbed, as in instances of an enlargement of similar parts, after the absorption of poisonous matter into the fingers of dissectors, from corrupting corpses, &c.

5th. Because, in abundance of instances, febrile ailments are followed by *mesenteric obstructions*, which, I suppose, are caused by the absorption of pestilential matter, either swallowed or generated in the intestines from putrified animal food, &c. as it may happen now and then that infectious matter, in flowing through the lacteals, may inflame the glands through which it passes, and excite in them tumour and its consequences.

6th. Because the quality of the blood in persons dead of the complaints already enumerated, is different, in many respects, from that brought on by mere exclusion of vital air, as in breathing septous and inflammable gases; leading thus to a persuasion, that, besides the *withholding oxygene*, there had, in pestilential ailments, been actually an *addition of something septic* to the circulating mass.

7th. Because, in many distempers of the summer and autumn, the colour of the blood circulating through the skin, and the hue of the skin itself, are considerably altered; and in this change of the skin from the ordinary flesh-colour to clay-coloured, dusky, yellow, purple, and black, there is something of a peculiar cast in pestilential diseases, that is not found to accompany any others: the complexion of persons dying under water, and in fumes of burning charcoal, being, in appearance, as well as in fact, considerably different.

8th. Moreover, I believe that pestilential matter is sometimes mingled with the circulating blood; because, though it has not been concentrated enough to produce, *in all instan-*

ces, diseases, when inserted by inoculation in the body of a well person; yet there are not wanting facts to evince its virulent influence, in some experiments that have been made. (HOME's Exp. on the Measles, &c.)

Left this idea of the power of the absorbents to imbibe such fluids may appear to be merely speculative, it may not be amiss to mention the experiments of MAXWELL, (*Experiment. cum diversis Aërum speciebus in Animalibus, &c.*) proving the thing to be really a fact. This gentleman, among various other experiments, produced artificial emphysemata, by forcing atmospherical, phlogisticated (septous), dephlogisticated (oxygenous), fixed (carbonic acid) inflammable (hydrogenous), and nitrous (septic) airs into the cellular membrane of living dogs and rabbits. The result of numerous trials was, that elastic fluids so injected, were very completely taken in by the lymphatics, though with different degrees of readiness; that all the airs, except *two*, produced, by absorption, scarcely any observable effect upon the body; that these two were SEPTOUS and SEPTIC gases; the *former* of which would not destroy life until after some days, while the *latter* KILLED IMMEDIATELY. When the septic gas was injected, it was so suddenly absorbed, that death came on not by its inflammatory action upon the superficial muscles, but by its being mixed in a *certain quantity with the blood*, and after conversion to *septous* or *septic* (nitrous) *acid*, by *conjunction with oxygene in circulating through the lungs*, STIMULATING THE HEART TO DEATH, and utterly destroying *all* the irritability of that muscle. (p. 12. and seq.) The experimenter computes, from the facts which presented themselves during his investigation, that this septic poison may be absorbed by the skin, and be conveyed to the heart in *about half a minute!* (p. 17.) Yet it must not be imagined, that, after pestilential venom is inhaled into the blood-vessels, death will in all cases be the consequence. The offending matter may be carried from the body through the excretory outlets; or it

it may circulate a long time with the other fluids, and so *season both the vessels and the heart* to its action, that, after a while, *they*, like the *external parts*, will grow *insensible to its stimulus*, and *no longer have their motions disturbed by it*.

You will observe that I reject altogether the notion of *putridity*, as it is *very generally supposed* to be going on in the blood-vessels; and that I have no faith in the introduction of *putrid ferments* into the mass of fluids. A putrefactive process taking place in the contained parts of the living body, except among the contents of the alimentary canal, is incompatible with life more than a few minutes. Putrefaction is a resolution of an organic body into its elementary atoms, or into new compounds. Now, many of these are gases, whose extrication in the blood-vessels would extinguish life in a very short time. Besides, the fluids produced by putrefaction having already undergone that operation, cannot be any more susceptible of it. They not only do not putrefy the muscles, but, in the common acceptation of the term, they retard putrefaction in other substances. Thus, *fixed air, nitrous acid, and volatile alkali*, which are reckoned among the most active *products of putrefaction*, are known to be some of the most *powerful opposers of it*. And it may be laid down as a pretty broad fact, that such substances as are *septic in their origin*, are *antiseptic* in their effects; and this necessarily, from the nature of things.

As to the *dark colour* of the blood drawn from the *veins*, in malignant diseases, and the *dissolved state* in which it appears, I consider them as having no manner of connexion with a putrefactive ferment within the vessels. It is very well known, (*Annales de Chimie*, tom. v. p. 266) that hydrogen gas, injected into the jugular vein, keeps the blood liquid, and imparts to it a colour almost as black as ink; and it is as well known, that the hydrogen gas obtained from animal substances contains a quantity of carbone in solution; so that *venous blood* owes its *dark hue*, and its disposition to fluidity,

fluidity, to the commixture of a quantity of *carbonated hydrogen*.—When vital air is freely admitted into the chest, and the lungs perform their functions well, the venous blood parts with its hydrogen and carbone, to form with the principle of acidity, water and fixed air, in the bronchia, and receives, from the pulmonic cells, a portion of oxygen in their stead. When, therefore, by an impediment of the respiration, as in breathing pestilential air, the hydrogen and carbone are imperfectly or not at all exhaled; and, at the same time, very little or no oxygen is absorbed through the lungs, the *black* or *dark colour*, and *disordered appearance* of the blood, and particularly the *venous*, follows as a thing of course. And whenever afterwards the pestilential matter absorbed is added to such blood, the deviations of colour, consistence, and other qualities from the healthy state, must be yet more considerable.

From a review of what has been stated in this letter, the probability of the following inferences will be apparent. 1. That the presence of carbonated hydrogen, and the absence of oxygen, will explain the common qualities of the venous blood. 2. That pestilential matter may impart to it a further change of qualities. 3. That pestilential matter does actually enter the mass of blood. 4. That the lacteals and lymphatics carry it there. 5. That the appearances of the blood are very much alike in all pestilential distempers, from agues to plagues. 6. That these phenomena are nearly analogous to those induced by the injection of septic and septic gases into the blood-vessels. 7. That from the similarity of effects in the cases when pestilential matter was absorbed, and where septic fluids were injected, the two classes of phenomena are referable to the same general cause.

Yours very, &c.

SAMUEL L. MITCHILL.

New-York, Aug. 1, 1796.

APPENDIX

APPENDIX B.

Illustrations of Mr. MITCHILL's Doctrine of the Operation of Pestilential Fluids upon the Human Body.—In a Letter to SIMEON DE WITT, Esq; Surveyor-General of the United States.

THE perusal of your instructive letter, dated at Albany, June the 2d, 1796, on the subject of my pamphlet about pestilential airs, which you are polite enough to call “an ingenious and valuable work,” has given me much pleasure. Availing yourself of the miscibility of contagion and infection with water, you propose steam or the *vapour-bath* as an additional means of removing it, and describe how the Indians apply and employ that remedy: I question very much, however, whether in pestilential complaints, occurring as they commonly do in North-America, in hot weather, it would unite so many good qualities as *clear cool water*.—I do not remember that the *earth-bath* which you mention was ever medically prescribed for persons labouring under similar distempers; though I remember a queer fellow in Europe who used to recommend it very seriously to his patients and the public, and to bury himself up to his neck as an example for them; he used to say the application of fresh earth was admirably calculated to invigorate the body by extracting the causes of diseases, and to strengthen the mind by operating as a *memento mori*; its similitude to interment, I rather suspect, would make it operate unfavourably upon terrified persons, who think it is quite soon enough to be buried after they are dead.—Such considerations as have occurred to me concerning some other matters mentioned in your letter,

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ter, are contained in the papers which I read last winter before the Agricultural Society of New-York.

You express your "full persuasion, that, under certain combinations in our atmosphere, gaseous fluids are the causes frequently of the worst maladies that afflict us, whether received by the absorbing pores of the skin, by the lungs, or by the bowels." In this sentiment I fully agree with you. But as this conclusion ought to be admitted with some restriction, or requires certain explanatory considerations, I shall now present you with the result of my reflections on the limits by which their pernicious operation is circumscribed.

When we speak in common language of the unhealthy or destructive effects of contagious or infectious matter, we generally wish to be understood as referring to their operation on the bodies of those to whom it is applied fresh, or who never felt its influence before. Thus, when it is affirmed the small-pox is a dreadful distemper, the expression is limited to those who have not been seasoned to its action; when it is asserted that the plague is very easily caught, the meaning is, by those whose constitutions have always been wholly untouched by it: when it is declared the yellow fever cuts off multitudes of men in the tropical climates, the remark particularly refers to new-comers from the temperate zone, &c.

I have laid it down as a fact in my doctrine of fever, that the sick get well in abundance of instances, less by the aid of the medicines they swallow, than because the stimulus of infection wears itself out.—The constitution in these cases becomes so habituated to the venom, that this no longer makes a sensible or morbid impression on it.—After a servitude of greater or less duration or violence, it seems at length to get emancipated.—By various degrees of indurance, it acquires a sort of immunity from the old source of inquietude, and obtains a discharge as it were from further vexation on that score. It somehow becomes enabled to live and be useful in times of distress and danger, with little or no molestation from
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the ordinary cause of mischief.—When pestilence summons the multitude, such persons enjoy their privilege, and are in the nature of exempts from its mandate.

Thus, it appears unto me there is a whole class of animal maladies which leave the system in a condition less liable than before to be incommoded anew by contagion or infection. Though I do not know that the human constitution can, *in any case*, acquire such a degree of apathy or inirritability as to be wholly and always free from successive attacks of these kinds of distempers, yet, in almost every one of them it experiences *something of such a tendency*. A citation of a few facts on this subject will at once elucidate the principle, and shew the analogy.

The small-pox, when invading in the natural way, leaves the constitution so little liable to be troubled by it a second time, that the art of inoculation has been contrived and practiced, with the view to induce in the body, artificially, whenever it was thought proper, an insensibility to the further operation of that contagion. A like insensibility is brought on by the measles and varicella.

Syphilitic contagion, applied to the urethra, will frequently, after exciting a variety of uncomfortable symptoms there, lose its power of stimulating any more, or wear itself out; (Hunter on the Venereal Disease;) such persons as have had it once being, under equal circumstances, not so likely to take the contagion afresh.

They who escaped the yellow fever which raged in Charleston, in South-Carolina, in 1748, were far less likely than before to be attacked by it; (Lining, 2 Essay Phys. Lit. p. 374) and on this immunity from the distemper, the writer expresses himself with great confidence.—The same remark has pretty generally been made by men of experience and observation between the tropics.

Small animals who have been kept for pneumatic experiments, and frequently made to breathe non-respirable airs,
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grow by degrees so far familiarized to their action as to suffer far less inconvenience and risk than at first.

Prisoners in foul jails, like the natives of unhealthy countries, may become, by degrees, so accustomed to pestilential air, that their constitutions will not be greatly disordered by its presence; while, at the same time, a person from a pure atmosphere, suddenly introduced, may suffer violent disease, or be quite destroyed by it.

During a pestilence which, in the former part of the eighteenth century, raged almost throughout Europe among the horned cattle, the German farmers would give almost any price for cows that had once had the disease, because they were seldom or never seized again with the plague. (Van Swieten apud Boerhaav. § 587.)

If the person who is seized with a quartan, says Sydenham, (Opera Universa. § 1. chap. 5. p. 49. 8vo) of whatever age or temperament he be, has been affected with a similar malady in any other period of his life, no matter how remote, this second invasion of the disease will not incommode him much, but will spontaneously leave him after a few fits.

Although patients are apt, from irregularity in diet and regimen, to *relapse* when in a state of convalescence from the plague; yet P. Ruffel declares, that re-infections were always regarded as remarkably uncommon; (Treatise on the Plague, B. 2. p. 190.) inasmuch that out of four thousand and four hundred pestilential cases, he met with only twenty-eight of re-infection, well ascertained. And he affirms, that convalescents in plague are much less prone to *relapse* than in other malignant contagious fevers. (p. 305.)

In all the conditions of the body now enumerated, you see there is a near and striking analogy; that is to say, by the application and continuance of any of the before mentioned species of poison, the animal solids may be rendered so insensible of its action, as at last to be little incommoded by it, or ultimately to experience no inconvenience at all.

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This unsusceptibility, thus induced, is the *τὸ θεῖον* of the ancients, the *divine something*, which brings the constitution safe out of the disease. Regardless of prescriptions and medical directions, the sick will get the better of their indisposition as soon as the pestilential cause loses its power of acting, and not sooner. While this accommodating process is going on, it is well known that fevers *cannot be cured*, and therefore the wisest physicians have carefully avoided too much interference, and have left the patient very much to *nature*, as they expressed themselves; meaning thereby, whenever the body grows insensible of the noxious stimulus, the sick would be restored to health, and not until then.

It strikes me, this view of the subject enables us to comprehend the doctrine of what have been called CRITICAL DAYS. These have given rise to much dispute, and considerable labour has been bestowed to find out the true *judicatory periods*. In a mild or equable climate, where the constitutions of the people, their ways of living, the air they move in, &c. are very similar, it is conceivable that febrile paroxysms ought to exhibit considerable regularity, and assume certain times of departure, as well as of approach; and that therefore, the tertian period of the third, fifth, seventh, ninth, and eleventh, may in common have been the natural order in Greece and the islands of the Archipelago; and when the disorder was protracted beyond the eleventh day, the quartan period of the fourteenth, seventeenth, and twentieth, might have been the ordinary rule. The critical days become more distant and uncertain as the distemper is prolonged, until they are quite obliterated. The true meaning of the term *critical day*, then, is, not that the *αὐτοπαλῆσις* excerns or drives off something noxious that day, but simply, *that then the habit is established of being no longer susceptible of infectious stimulation*.

I can conceive likewise, that there may occur now and then, from special causes, an exception to this general rule,

and that a distemper may terminate on the eighth, tenth, twelfth, fifteenth, sixteenth, or any other day which is usually *non-critical*.

In all infectious and contagious diseases, there is a certain course, which they will run, notwithstanding the administration of remedies; and when that course has been run, they may terminate without the aid of remedies. Does physic possess specifics of power sufficient to prevent the variolous matter from acting on the solids? No; the contagion of small-pox stimulates until it can stimulate no more, and then the sufferer recovers. In like manner the infection of pestilence will attack the body, and continue its attacks until an insensibility to its action is brought on, and afterwards the sickness will terminate. In both cases, the prudent physician knows the most and best he can do is to *conduct the sick in safety to the end of their malady*. None but the ignorant and presumptuous will pretend to be able to cure them. When, therefore, HIPPOCRATES and SYDENHAM proceeded moderately with their patients, they acted with a degree of sense and consideration infinitely superior to those idle calumniators who have lately found fault with such feeble practice, and whose empirical rashness has led them wholly astray from the true principle of proceeding. Under the impression of such sentiments it probably was LIEUTAUD animadverted (*Precis de la Medicine*, p. 37.) upon the multiplicity of *remedies*, and RAMMAZZINI lamented (*De abusu Chinæ Chinæ*) the *mischiefs done by Peruvian bark*.

The immunity which the constitution acquires under the varied forms of infection, will not in *all* cases *be equally lasting*; nor in *any* will it amount to an absolute security against a second attack. The plague *may* make a second onset; the small-pox has done the like. Such seems to be the operation of infected air.

However, if the principles herein-mentioned are right, a plain inference is, that there may exist a condition of body
not

not merely able to escape infection, but capable of being actually benefited by its presence.

It has accordingly been remarked, that persons prone to consumption were not so likely as others to suffer from the infection of plagues in the unhealthy parts of Europe and Asia.

We are informed that the pestilential rice-grounds of Georgia exhale an effluvium of such a quality as to cause mortal remittents in the fount, and at the same time affording signal relief to the phthysical.

There can be little doubt, that one principal benefit done to pulmonic ailments, by voyages to the south, proceeds from the impregnation of the atmosphere by infectious airs.

I hold it certain, there is always pestilential gas in and around the habitations of men, though it but rarely becomes sufficiently accumulated or concentrated to operate much in cool northern places.—But the case is otherwise in the lower latitudes towards the equator, where it is common for so much non-respirable air to generate as to bring on the distresses of pestilence, while it keeps off the ravages of consumption.

It has been asserted that pestilential maladies chiefly affected the lower classes of people and the indigent. This indeed is very much the case. But people in the higher walks of life, physicians, princes, priests, and noblemen, have frequently fallen victims to their violence. (*Biblische Ergetzlichkeiten*, S. 947.) So that the wealthy and the great have by no means an entire exemption. See *Misander's* uber. 2 Sam. chap. 24.

But in seasons of pestilence, certain tribes of animals are exempted more completely than any description of men, particularly many of the species of reptiles and insects. It seems, that in the œconomy of nature, these, though many of them are breathing animals, do require an atmosphere different from that which suits the constitution of mankind and quadrupeds.

They

They are bred in the midst of pestilential air, and thrive best in it.

On considering the history of modern endemic distempers, and comparing it with the relations made in the eighth, ninth, and tenth chapters of Exodus, the plagues of Pharoah will be found to be very analogous, and to succeed each other in a very orderly progression. They are almost all local, and such as might be expected to happen in a valley of considerable width near floods of the Nile. The conversion of the river into blood will admit of the same explanation with supposed showers of blood; and the rain there, in the opinion of an agreeable writer, (1 Pott. *Essai sur la Nature*, &c. ch. 8. p. 115.) may be coloured red during its descent by the dust washed from certain insects, by the presence of microscopical insects themselves, or by fluids emitted by the insects; or after its fall it may acquire its sanguine colour from oker or reddish earth brought down from the mountains. The excessive multiplication of *frogs*, *ticks*, (lice) and all sorts of *flies* (gnats and musketos) swarming about, starving and dying upon the land, were sufficient to contaminate the air and generate pestilence among domestic animals, and to cause ulcers and burning pustules on the human species. I have endeavoured elsewhere to prove, that bitter cold in the atmosphere is to be explained upon the same general cause which produces pestilence. The occurrence there of hail and lightning, (see my letter to Mr. *Valentin*) and subsequent darkness are all very natural, as well as the extraordinary production of grasshoppers, (locusts) and the mortality among the young Egyptians. (CALMET sur L'Exode. p. 65 and seq.) This coincidence of pestilence and hail is very remarkable, and is strictly conformable to philosophical truth.

There is another instance of exemption which occurs to me, and that is of the white people of Nantucket and Martha's Vineyard, when such sad mortality prevailed among the Indians in 1763. The Indians alone suffered from it in these

two islands. The account given of this pestilence, by Mr. Oliver, in his letter to Mr. Mauduit, is very short and incomplete. From it, however, we learn, that the *Indians had been scantied in their allowance of corn*, which led them probably to the consumption of a greater quantity of fish for food: in this way the distemper might have arisen. We learn further, that the disease so produced was attended with *a violent inflammatory fever, which carried them off in about five days*, resembling, in these respects, the endemic disorders of New-York and Philadelphia. And we learn further, that the *Indians chiefly lived and died by themselves*: whence it would be not at all difficult of explanation, why the white inhabitants, who had better food and lived in distinct parts of the islands, altogether escaped.

As your official situation puts it in your power to collect information with great advantage from the westward, I have to request you will ascertain for me the effects which the air of those nitre-grounds, mentioned by Mr. Secretary Pickering, in one of his reports, has upon animal bodies, and especially upon human constitutions. In so doing you will aid the cause of science, and greatly oblige your sincere friend

SAMUEL L. MITCHILL.

New-York, June 14, 1796.

SIMEON DE WITT, Esq.

THE END.

Johnson, William S.

An inaugural dissertation on the operation of pestilential fluids upon the
large intestines, termed by nosologists dysentery

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